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As Listed Herein

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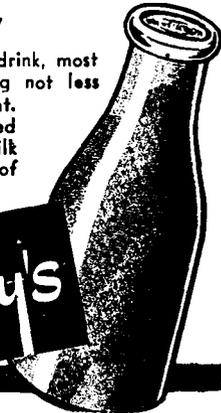
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Message of the President



"WHEN the lights come on again all over the world." Not so long ago these words were associated with times and conditions, in a world turned upside down by war. The lights are on now, the war is over, and we can look ahead to a new era. Another milestone has been passed in the history of our country.

The INTERNATIONAL ASSOCIATION OF MILK SANITARIANS enters this post war period with a clear vision of its responsibilities and with a determination to make the most of its many opportunities for service. If any good comes from war it must be reckoned in achievements obtained through war-provoked research and its application to the welfare of the future generations. We can look forward to new developments in equipment, cleansing agents, sterilizing agents, control instruments, packages, etc., all of which will contribute to the production and processing of higher quality milk and milk products. We must be on the alert and keep in stride with the ever advancing front line.

Sanitarians, these last few years, have had many trying experiences. It is needless to enumerate the various problems presented for solution. However, all in all, the results achieved stand out as a tribute to the spirit and determination of this group to accept responsibilities and overcome difficulties. These experiences are going to be helpful in meeting the problems of the future. In too many instances, desired milk control standards have been impossible to maintain and some well planned improvement programs were necessarily abandoned. With the apparent improved conditions of the future, it is well for sanitarians to initiate programs built around peace time conditions and requirements, ever keeping in mind our responsibilities as public health workers. Our first obligation is to the public.

Our Association enjoys a most enviable position in the field of milk sanitation. The membership is increasing steadily each year. Along with this increase

in membership and the resulting increase in the distribution of the JOURNAL, the influence of the Association becomes greater. No small part in this growth has been due to the efficient and untiring efforts of our past Secretary-Treasurer, C. S. Leete. It was with regret that the Executive Board accepted his decision to give up the office. Few of us realize just how important this office is, nor how much time our Secretary is called upon to give to Association affairs. I want to join with the members of the Association in expressing their appreciation to Sid for his all important contribution.

I wish to express my sincere appreciation for the opportunity to serve the Association as President. May you all enjoy your full share of good fortune throughout the entire year.

R. G. Ross, *President*

Laboratory Procedures in Sanitary Milk Control*

UNDER the above title Dr. Robertson summarizes the evidence and outlines the laboratory procedures in two systems for the sanitary control of milk: 1. As provided for in the Milk Ordinance and Code of the U. S. Public Health Service (which he calls Plan A), and the other procedure, in the procedure of the Connecticut State Department of Health designated as Plan B. The reader is referred to the original excellent article for a thorough, authoritative, and clear presentation of the distinctive features of each method, followed by suggestions for their improvement.

The procedures are briefly as follows:

Plan A requires the laboratory examination for four samples of milk and cream from each farm and plant in every grading period, of not to exceed six months, and also an inspection of dairy farms and milk plants. Raw milk itself is graded on the use of standards expressed in terms of the standard plate count, the clump microscopic count, the individual microscopic count, and the methylene blue reduction time. Pasteurized milk is examined only by the agar plate method. These data constitute the basis for placing the producer in a quality class designated by letters of the alphabet, Grade A being the highest. Non-compliance with the standard penalized the producer by degrading his milk to a lower grade (at a consequently lower market).

Plan B requires a laboratory examination of the milk from each farm and plant. Three separate samples are examined, quarterly when possible. For grading purposes, the agar plate method is used. All samples of milk and cream are examined by the direct microscopic method; all allegedly pasteurized milk samples are continually examined by the phosphatase test and by the coliform test. Infractions are followed by check tests, warnings, hearings, and (when infraction persists) then exclusion from sale.

He discusses at length the advantages and disadvantages of the laboratory procedures under the two methods, and particularly compares the limitations of replicability and usefulness of the agar plate method, the direct microscopic counts, and the reduction methods. In lighter vein, he refers to tradition as favoring the agar plate method and to its "sanctification" by a "vote of confidence" in the early days of milk control.

What Robertson has done so well for laboratory procedures needs to be done for the whole control procedure. This need is indicated by the very fact that we have Plan A and Plan B both so similar in objective but different in pro-

* *Amer. J. Pub. Health* 36, 1245 (1946).

cedure. A clue to the philosophy on which they rest is presented by the source from which each springs: Plan A was devised by engineers and Plan B by a "regular" health department (meaning a physician in charge of health work, responsible for the administration and interpretative work of bacteriologists, chemists, and inspectors). Of course Plan A uses these "tools" also, but its emphasis is different.

In practice, Plan A is a control, set up along the lines that industrialists use to produce consistently a line of goods of desirable and dependable quality. It cross-sections the output at regular intervals, regardless of whether the quality is good, bad, or indifferent. Its strength is its regularity and frequency.

Plan B operates more on the principle which underlies the police power of the community. In general, a community has its building code, its traffic laws, its sanitation rules and regulations, and other such police measures. These serve to guide the citizen so that he can comply with the local requirements. Then he is allowed or permitted to begin whatever he has in mind: build an apartment, operate a garage, drive a car, or open a dairy. His continued compliance is assumed by reason of his being a reputable citizen. The community employs policemen and inspectors to keep a general check-up. The police do not control; they instruct, supervise, and when necessary, restrict (arrest).

Each system has its advantages and disadvantages. A thorough analysis of these would be helpful—just as Robertson's analysis of the two laboratory procedures advances our knowledge by showing the two systems in contrast.

J. H. S.

Food Sanitation

IT is interesting, to say the least, to note the increasing attention that food control officials are taking in food cleanliness. The word "sanitize" is such a technical word that our use of it inclines us to lose sight of the fact that this big (!) word really means to get rid of dirt (and worse—infectious material). For too long we have looked upon dirt as being just "misplaced matter," something not so good and also not so very bad. Some people refer to this in more euphonious terms, as for example, "extraneous material." The food people come right out and call it "filth." That is not a pretty word but it is a correct one. Maybe food sanitarians would be stirred up to more energetic corrective measures in some quarters if this idea of filth in food registered more strongly with them.

In the November issue of the *Journal of the Association of Official Agricultural Chemists*,* Harris of the Food and Drug Administration has compiled a bibliography of methods for the examination of foods for filth, comprising 156 titles, arranged also by subjects. The field covered is as follows: Filth in the form of insects, insect parts, and insect excreta, or in the form of rodent excreta and hairs; sand; microorganisms as an index of the presence of manure; data relevant to the Howard mold count; and some extraction methods for soil and other materials where there appears to be an applicability, even though as yet unexplored, to foods. He points out that entomologists, mycologists, chemists, botanists, and bacteriologists "will probably take a more active part in regulatory food control in the future." He has rendered food control a distinct service by assembling all these references. He points out that "the science of filth detection is as yet relatively young, although information on sediment in milk was

* Vol. 20, p. 420-439 (1946).

published in the early 1900's. . . ." We modestly bow to his compliment that "The 'dirty milk' problem demanded and received continuous attention." The public do not want to eat filth, even if it is pasteurized or sterilized—or otherwise "embalmed," as Bill Palmer puts it. If the public responds to clean, safe food as enthusiastically as it has to clean milk, then a new era of expanded sales may be expected to result from correction of much of present practice.

A by-product of our work to produce clean milk resulted in the discovery of ways to improve flavor, food value, eye appeal, and convenience. It is to be expected that the application of present-day technical information to food production and handling will result in new knowledge in this field also.

J. H. S.

HOMOGENIZATION in a New Application

HOMOGENIZATION has been used for a long time in the evaporated milk and ice cream industries. Lately it has invaded the milk industry as such. We also find it being applied to other foods, and even to products in the chemical industries. Recently we came across a new application. Dr. Mendell Taylor, Professor of History in the Nazarene Theological Seminary, writes * as follows:

"In recent years the dairy industry has produced a popular type of milk which is called homogenized. By a rather simple operation the cream molecules are evenly dispersed through the entire liquid content. The cream line disappears and the last portion of the milk tastes the same as the first swallow. . . . In the homogenized milk a uniform quality obtains through and through.

"The principle of homogenization needs to be carried into every phase of life. Too often a dual personality is allowed to develop which is rich at one level but thin at another level. One area of life partakes of the cream line portion and the other area of life dips into the skimmed milk section. But in the homogenized life these sharp cleavages are banished. The margin between motives and actions disappears. The exterior is not polished for the sake of making a good impression, or to mask the lack of internal integrity. A few rules of social grace are not learned so that the best foot can be put forward in order to use someone as a means to an end. The cream of courtesy is not smoothly exhibited while the skimmed milk of intention is scheming and self-centered. . . .

"Too often a dualism develops in the field of social adjustments. The cream of the crop is bestowed upon a certain clique of favorites while the skimmed milk thinness is given to those outside the select circle. The finished side is on display for the inner circle but the seamy side of snobbishness is given to everyone else. But in the homogenized life these caste systems disappear. . . .

"The most devastating thing that can be said about a person is that he makes a good impression at first but he soon becomes shopworn and boring. But in the homogenized life this thinning out disappears. When there is genuine richness through and through, one bears acquaintance. Then the highest compliment possible is in order, namely, 'You like him better the more you know him.' Through being planted by 'the rivers of water' the rootage of our lives will sink into God and there will be a uniformity of quality from the surface into the depth of life.

"In the final analysis, the homogenized life is the integrated life."

J. H. S.

* *Herald of Holiness*, Nov. 11, 1946.

Restaurant Sanitation Program of the U. S. Public Health Service*

A. W. FUCHS

Sanitary Engineer Director, U. S. Public Health Service, Washington, D. C.

FIVE years have passed since my discussion of the U. S. Public Health Service restaurant sanitation program at the annual meeting of this Association at Tulsa (1). That was, I believe, the first or, at least, one of the earliest discussions of the subject of eating establishment sanitation to appear on your programs. It is, perhaps, significant that the present paper on this subject is presented at the very meeting of this Association when consideration is to be given to the question of extending membership to food sanitarians as well as milk sanitarians.

During these five years, the public health problems associated with the Second World War have come and gone, and the restaurant sanitation program of the Public Health Service has grown from lusty infancy to vigorous maturity. The need for control of eating establishment sanitation has been recognized as never before by state and local health authorities, the industry, and the public. Many communities, spurred by the public clamor for cleaner food service, have inaugurated or intensified this activity.

In these endeavors the Public Health Service acts solely in an advisory and stimulative capacity. It leaves actual enforcement to state and local health authorities, for it has no legal jurisdiction in the control of sanitary conditions except on interstate carriers, and even in this field it enlists the cooperation of state health authorities wherever possible. Its program is, therefore,

designed to assist state and local regulatory agencies and other Federal agencies which have the necessary legal authority. Its aim, in brief, is to promote the establishment of effective, well-balanced milk and food sanitation programs in each state, to stimulate the adoption of effective state and local control legislation, and to encourage strict and uniform enforcement through appropriate legal and educational measures.

To implement these aims the Public Health Service compiles annual reports of disease outbreaks from water, milk and milk products, and other foods, prepares model ordinances, undertakes and supports research on food sanitation, furnishes technical and administrative advice and interpretations of recommended standards, trains state and local sanitarians through personal contacts and regional seminars, prepares technical and educational materials for the training of sanitarians and food handlers, conducts demonstration schools for food handlers, makes surveys of state or local conditions upon request, allots funds to the states for the support of public health activities through Title VI of the Social Security Act, and consults with equipment manufacturers and food industry representatives on the design and construction of food utensils and equipment. During the war period Public Health Service personnel were assigned to state health departments for food sanitation duty in the more important military and war industry areas, and mobile laboratory units assisted state and local departments in areas lacking laboratory facilities.

* Presented at the thirty-third annual meeting of the INTERNATIONAL ASSOCIATION OF MILK SANITARIANS, Atlantic City, N. J., October 24-26, 1946.

IMPORTANCE OF FOOD ESTABLISHMENT
SANITATION

The public health control of food establishments is necessary from a number of viewpoints. To the general public which patronizes these establishments the need is largely esthetic—it demands food service under conditions not repugnant to its sensibilities. To the restaurant industry the meaning is principally economic—satisfied customers and avoidance of damage suits. To health officials the problem is one of preventing food-borne disease.

Since 1923 the Public Health Service has compiled annual reports of milk-borne outbreaks of disease submitted by state health departments, and since 1938 these compilations have been extended to include outbreaks traced to water and to other foods. During the 7-year period from 1938 to 1944 there were reported an annual average of 44 outbreaks from water, 41 from milk, and 212 from other foods (Table 1). In other words, outbreaks traced to other foods have been nearly three times as numerous as those from water and milk combined. Another significant feature is the trend: while outbreaks attributed to water declined during the war years, and those from milk showed no significant change, a steady increase occurred in outbreaks and cases traced to other foods. There is no doubt that the reported outbreaks and cases represent only a fraction of those actually occurring. These figures offer an obvious challenge to health officers and sanitarians to control the cause of food-borne disease. Protection of water and milk supplies deserves continued effort, but food sanitation obviously demands increased emphasis.

Of the diseases involved in food-borne outbreaks, food poisoning and gastroenteritis are by far the most common. Thus, of 298 food-borne outbreaks reported for 1944, the diseases involved were: botulism, 9; chemical food poisoning, 8; dysentery, 7; food poisoning, 157; gastroenteritis, 94; trichinosis, 7; typhoid fever, 10; others,

TABLE I
SUMMARY OF DISEASE OUTBREAKS FROM WATER, MILK, AND OTHER FOODS, 1938-44

Year	Water			Milk and Milk Prod.			Other Foods			Undetermined			Total		
	Out- breaks	Cases	Deaths	Out- breaks	Cases	Deaths	Out- breaks	Cases	Deaths	Out- breaks	Cases	Deaths	Out- breaks	Cases	Deaths
1938	48	31,693*	17	42	1,685	27	70	2,247	25	8	882	3	168	36,507	72
1939	43	2,254	3	41	2,509	7	146	3,770	12	17	1,203	6	247	9,736	28
1940	43	44,184†	9	43	1,678	10	218	5,588	30	18	1,088	1	322	52,538	50
1941	60	12,039	24	37	1,049	4	223	6,070	53	20	1,876	24	340	21,034	105
1942	53	13,271	9	45	2,142	2	245	11,420	101	37	1,878	10	380	28,711	122
1943	26	5,712	15	40	1,590	7	285	13,938	33	38	2,525	1	389	23,765	56
1944	32	2,686	1	41	1,449	20	298	14,558	45	22	1,683	1	393	20,376	67
1938-44	305	111,839	78	289	12,102	77	1,485	57,591	299	160	11,135	46	2,239	192,667	500

* Including a water-borne outbreak of gastroenteritis with 29,250 cases.

† Including a water-borne outbreak of gastroenteritis with an estimated 35,000 cases.

6. Practically all of these diseases are controllable through appropriate sanitary measures, including refrigeration.

An analysis of the disease outbreaks reports would yield some very interesting information as to the organism involved, the kind of food, and the method of contamination, but for the purposes of the present discussion an examination of the type of establishment involved may be of particular interest. This information is available for 264 of the 298 food-borne outbreaks reported for 1944, and shows the following distribution: public restaurants in 49 outbreaks; schools and colleges, 38; food shops, 31; hospitals and institutions, 29; industrial cafeterias, 19; labor camps, 16; railroad train, 1; private homes, 50; private parties, 14; picnics, 9; and church suppers, 8. The last four types of establishments, involved in 81 outbreaks, are of a private character; but the remaining 183 (70 percent of the total) are public or semi-public food places which should be subject to control by health authorities.

RECOMMENDED RESTAURANT ORDINANCE

In the paper previously mentioned (1), I outlined the development of the Ordinance and Code Regulating Eating and Drinking Establishments recommended by the U. S. Public Health Service, and discussed some of the problems involved in drafting an ordinance that would be generally applicable.

It was pointed out that the Public Health Service Sanitation Advisory Board debated the advisability of including a provision for health examinations but concluded that the conflicting opinions of health officers on the value of routine examinations of food handlers did not warrant such a requirement. Instead, the responsibility for prohibiting persons with communicable disease or in the carrier stage from handling food was placed upon the management; broad powers of con-

trol when infection is suspected were conferred on the health officer; and education of employees in food handling sanitation was recommended.

The question as to enforcement methods was settled by offering two different forms of the ordinance, one a grading type which permits enforcement by degrading or permit revocation or both, the other a non-grading minimum-requirements type enforceable by permit revocation only. In the grading type, the competitive effect of grading on public patronage tends to improve conditions in eating establishments, thereby aiding in enforcement. The provisions of the several sections of the recommended ordinance were also briefly outlined. It is unnecessary, therefore, to discuss these subjects further at this time.

The editions of 1935, 1938, and 1940 were mimeographed, but the current edition of the ordinance and code was printed in 1943 as Public Health Bulletin No. 280. It is the culmination of nine years effort represented by five different drafts. It embodies the best information on restaurant sanitation available in 1943, but like other codes recommended by the Public Health Service it is subject to change as improvements are developed through research and experience. Suggestions for improvement are invited and given careful consideration by the Sanitation Advisory Board before new editions are prepared. Many proposals submitted by health officers, sanitarians, and members of the industry are now being studied.

Among the principal proposals under consideration is the broadening of the scope of the ordinance to include not only eating and drinking establishments but also all other types of food establishments. At its annual meeting in Washington in April of this year the Conference of State and Territorial Health Officers approved the report of its Committee on Interstate and Foreign Quarantine which recommended

that an investigation be made of the desirability of such a move. To quote from the Committee's report: "A number of State and local health departments have suggested that the PHS Ordinance and Code Regulating Eating and Drinking Establishments be expanded to incorporate provisions applicable to other types of food handling and food processing plants, including bakeries, confectioneries, manufacturers, groceries, meat markets, slaughter houses, etc. Meat packing plants shipping interstate are inspected by the U. S. Department of Agriculture, and interstate shipments of other food products are under the supervision of the U. S. Food and Drug Administration; but meat and food not entering interstate shipment receive only such supervision as the states and local communities may provide." While the basic principles of sanitation of the restaurant ordinance are generally applicable to all food establishments, a careful study will be required to determine the additional provisions needed particularly applicable to each type. It may be some time, therefore, before the scope of the ordinance can be widened.

Other revisions of the ordinance will undoubtedly result from research studies being conducted by official and unofficial agencies, including the Water and Sanitation Investigations Station of the Public Health Service at Cincinnati, the National Sanitation Foundation, the American Public Health Association, and laboratories that will soon be receiving research grants for sanitation studies awarded by the Public Health Service upon the recommendation of the National Advisory Health Council. To date the Cincinnati Station has investigated detergents (2), has developed a method for determining their overall efficiencies (3), and is now engaged in a basic study of the bactericidal efficiency of quarternary ammonium compounds. The National Sanitation Foundation, supported by enlightened segments of industry, has

made grants for studies on dishwashing machines, cold sterilization by chemicals, and other projects concerned with food sanitation. It has aided the Subcommittee on Food Utensil Sanitation of A.P.H.A. in studies to improve the swab test for determining residual bacteria on food utensils. To those of us who for years prayed for facilities to furnish the answers to the many unsolved problems of sanitation, this ever increasing tempo of research bears promise of a new era.

The ordinance is recommended for voluntary adoption by states, counties, health districts, and municipalities in order to encourage a greater uniformity and a higher level of excellence in the sanitary control of eating and drinking establishments. The ordinance itself is only a few pages in length. The accompanying interpretative code gives the public health reason for each item as well as details of satisfactory compliance. By unifying the interpretation of the ordinance, the code serves to minimize enforcement misunderstandings. Paralleling the ordinance are inspection forms for field use and office ledger record forms for posting inspection and laboratory results, both available for quantity purchase from the Government Printing Office.

No better indication of the need for sanitary control of eating places could be desired than the rapid pace at which the model ordinance has been adopted throughout the United States. This ordinance or one based thereon is now in effect statewide in 15 states and the District of Columbia, as well as in 176 counties and 373 municipalities located in 37 states and territories, with a population coverage of over 40,000,000. It has been adopted as state regulations in 25 of these states. Operating under the ordinance are 30 cities of over 100,000 population. A complete list of adoptions is available from the Public Health Service.

The grading type of the ordinance is in effect in 7 states, 71 counties, and 175 municipalities; the non-grading

type in 18 states, 101 counties, and 163 municipalities; and the type is not reported for 4 counties and 35 municipalities. Apparently, a non-grading ordinance or regulation is somewhat more popular than a grading type.

The distribution according to the edition of the Public Health Service ordinance adopted is as follows: 1935, 5 cities; 1938, 6 states, 65 counties, 100 cities; 1940, 13 states, 101 counties, 144 cities; 1943, 6 states, 7 counties, 84 cities; edition unknown, 3 counties, 40 cities.

ASSISTANCE TO STATE AND LOCAL PROGRAMS

Although adequate ordinances are essential, the mere adoption of an ordinance does not guarantee proper enforcement. Much depends on the activity and intelligence of the enforcing agency and on the qualifications of its inspectors. To promote effective enforcement by state and local health authorities, the Public Health Service operates through the Milk and Food Section of the Sanitary Engineering Division in Washington, the eight district offices in the field, and the Water and Sanitation Investigations Station in Cincinnati on research. Each district office has on its staff two or three specialists in milk and food sanitation under the administrative direction of the district directors and the technical supervision of the Milk and Food Section. These specialists are men of various professional backgrounds in the field of public health, including veterinarians, dairy graduates, bacteriologists, chemists, and sanitary engineers.

To assist the states in the improvement of restaurant sanitation, the Public Health Service engages in the following activities:

1. It promotes the organization of an adequate restaurant sanitation program in the state health departments, and the employment of trained sanitarians qualified to exercise leadership and offer guidance to local inspectors. Of material assistance is the allotment

of funds to the states for the support of public health activities, appropriated by Congress under the authorization of Title VI of the Social Security Act. According to reports received as of June 1944, legal jurisdiction over restaurant sanitation was vested in the health department in 35 states, in the agricultural or some other department in 8 states, and in both health and agricultural departments in 5 states. But even in the states where the health department does not have legal control it invariably renders advisory service to local health agencies. Within the state health department, restaurant sanitation is a function of the engineering or sanitation division in 28 states, of the food and drug division in 7 states, of some other division in 5 states, and of the engineering and some other division jointly in 5 states.

2. Upon request, interpretations of the ordinance and code provisions and advice on technical and administrative problems are made available through correspondence with the Milk and Food Section and the district offices and through field consultation with the latter.

3. It trains new personnel upon request of the state health departments. This is accomplished largely by the district specialists working with state sanitarians to demonstrate proper methods of inspection, sampling, grading, rating of communities, record keeping, and administration.

4. It provides in-service training for state and local sanitarians through restaurant sanitation seminars conducted periodically in collaboration with the states on a state or regional basis. During 1945, 13 restaurant sanitation seminars were held throughout the country with an attendance of 564 state and local sanitarians. One of the usual features of these seminars is the presentation of a course of instruction to food handlers so that sanitarians may be in position to inaugurate such courses in their own communities.

5. Evaluations are made of state and

local programs by the district specialists upon invitation. States are assisted in making restaurant sanitation ratings of individual communities by the Public Health Service rating procedure. These ratings represent the weighted percentage compliance with the restaurant sanitation standards, and are of value in measuring results and stimulating improvement. Of the 147 communities for which reports were received during the past few years, 29 were rated below 40 percent, 92 were between 40 and 60 percent, and 26 were above 60 percent. Some of the low ratings represented conditions prior to the inauguration of a local restaurant sanitation program. Supplies of rating forms are furnished to states upon request.

6. The cooperation of the industry is solicited in support of state and local restaurant sanitation programs and in the manufacture of food equipment and utensils of sanitary design and construction. One of the outstanding features of the past two years has been the restaurant industry's awakened interest in sanitation through its national, state, and local associations.* Adequate local control programs are approved by the most enlightened members of the industry. Manufacturers of dish-washing machines, realizing the need for improvements, are supporting basic research in this field. Although the food equipment industry is many years behind the milk equipment industry in the production of easily cleanable equipment, there are indications of a desire for improvement as soon as better materials are again available to the industry for new designs. A particular source of complaint has been the lack of cleanability of cracks and crevices of chef whips and similar items. It should be clearly understood that it is the established policy of the Public

Health Service to issue no approval of any patented or proprietary article or device. However, opportunity is afforded manufacturers to consult with this office on methods of compliance with recommended standards; and confidential opinions concerning local acceptance of specific materials and equipment are furnished health officers upon request.

7. Factual and technical assistance is given to writers in the preparation of articles on the need for restaurant sanitation for popular magazines.

8. During the war years mobile trailer laboratories assigned to the district offices assisted state and local health departments in the bacteriological examination of milk supplies and restaurant utensils. The need for improvement in the sanitization of utensils is emphasized by the results obtained during 1945 from 5,684 establishments located in 213 communities. Of over 56,000 utensils sampled, only 26 percent complied with the bacterial standard of not more than 100 organisms per utensil surface examined. Of the four types of utensils routinely examined, spoons made the best showing and cups the worst, while water glasses and beer glasses were intermediate. With the war emergency over, the mobile laboratories were discontinued in June of this year.

9. During the war period, reserve officers of the Public Health Service were assigned to state health departments for duty in important military and war industry areas lacking adequate local health services. Among those so assigned were milk and food sanitarians. As this program was made possible through emergency funds appropriated by Congress, it, too, was discontinued in June of this year.

10. For the past three years the Public Health Service has devoted major attention to the portion of its restaurant sanitation program concerned with the education of food handlers.

* The National Restaurant Association recently announced the appointment of a Sanitation Committee which is planning an expanded program of cooperation with health authorities and education of employers and employees.

EDUCATION OF FOOD HANDLERS

Until recently local control programs relied primarily on legal penalties, such as fines, revocation of license, or degrading, for correction of insanitary conditions. Today it is generally recognized that education of food handlers is an effective method of obtaining compliance with sanitary standards. Sanitarians have discovered that most food handlers will improve their methods and acquire sanitary habits with proper instruction, and that legal procedures may be reserved for the recalcitrant minority. The sanitarian who employs the educational rather than the legalistic approach is the one who achieves the most permanent results. The reasons should be obvious: the policeman attitude tends to create resentment and opposition rather than cooperation, and to overemphasize equipment and structural standards at the expense of methods.

Employees of food establishments should have some knowledge of food-borne disease and modes of transmission, should be thoroughly acquainted with food handling and food utensil sanitation, should understand the danger of working when ill or with discharging or presumably infected sores or wounds, and the importance of being meticulous about personal hygiene, particularly cleanliness of hands and finger-nails.

To stimulate the development of food handler training courses by states and cities, the Public Health Service through its district staffs inaugurated a series of demonstration schools late in 1942. Up to July 1946, 123 schools were conducted in cooperation with state and local health departments, local restaurant associations, and other civic groups, with a total attendance of 64,000 employees of food establishments. In addition, 19 schools were held for 9,700 employees of railroad and airline dining cars and commissaries; 19 schools for 1,800 food handlers on Indian reservations; 14 for 1,900 cafeteria employees at indus-

trial plants; 11 for 813 dietitians and food handlers at hospitals; and 9 for 1,600 food handlers at military installations. Most of these courses have consisted of three 1½-hour classes or two 2-hour classes, repeated as often as was necessary to accommodate the attendance.

Largely as a result of the impetus from these demonstrations, organized food handler schools are at present being conducted by 30 state and territorial health departments and by at least 96 cities and counties. In some cities a certificate of completion of a food handlers' training course is a prerequisite for employment in food establishments.

To be successful, such schools must be carefully planned, organized, and conducted. A manual for use in organizing and conducting classes for food establishment employees, entitled "Guide to Safe Food Service" (4), has recently been published by the Public Health Service and is available from the Government Printing Office at 15¢ per copy. Lectures must be supported by suitable demonstrations and visual aid materials such as booklets, posters, slides, sound slide films, and sound movies. Among the materials on restaurant sanitation developed by the Public Health Service are the following:

- (1) A mimeographed outline of six lectures for food handlers' training courses.

- (2) 175 lantern slides with descriptions of each, for use at food handler schools. The use of these has been discontinued as they have been replaced by

- (3) A series of four sound slide films entitled "Our Health in Your Hands," constituting a visual outline of the material that should be presented at a restaurant employees' training course. The subtitles of the four films are: (1) Germs Take Pot Luck; (2) Service with a Smile; (3) In Hot Water; (4) Safe Food for Good Health. The four films with recordings

are available from Castle Films, Inc., 30 Rockefeller Plaza, New York 20, N. Y., for \$10, less 10 per cent discount to non-profit institutions.

(4) A pocket-size manual of instructions for food handlers entitled "From Hand to Mouth." Because of its simple language, its humorous illustrations, and its emphasis on the importance of the food handler's job, this booklet has achieved wide popularity. It is available from the Government Printing Office as Community Health Series No. 3 at 10¢ per single copy or 6¢ in lots of 100 or more.

(5) A series of six posters in four colors, size 10" by 14", entitled "For Our Patrons Health," intended for display in restaurant kitchens and wash rooms. Subtitles are: (1) Wash your hands often; (2) Use a fork—don't be a butter-finger; (3) Keep these cold; (4) Keep these under cover; (5) Handle with care; and (6) Wash every piece carefully. A discussion of the public health aspects of these posters appears in "Sanitary Measures Hold Restaurant Customers" (5). The posters are purchasable from the Government Printing Office at 25¢ per set.

(6) An article on dishwashing for the guidance of sanitarians and the industry entitled "Methods of Sanitizing Eating and Drinking Utensils" (6).

(7) A list of films on milk and food sanitation.

(8) A list of references on restaurant sanitation.

Free sample copies of the posters and publications listed above are available from the Public Health Service.

Sanitarians interested in organizing food handler schools in their communities may apply to their state health department and to the district office of the Public Health Service for assistance.

FEDERAL AGENCIES AND INTERSTATE CARRIERS

To complete the picture of Public Health Service activities in the field of food establishment sanitation requires

at least a brief mention of the advisory service to other Federal agencies and of the control of interstate carriers.

At the request of certain Federal agencies, and under formal agreements with them, the Public Health Service renders advisory and consultant field services on all aspects of sanitation at their various installations. Among these installations are the penal and correctional institutions of the Bureau of Prisons, the numerous parks of the National Park Service, the schools and institutions on Indian reservations under the Office of Indian Affairs, the resorts and camps of the Forest Service, and the blister rust camps of the Bureau of Entomology and Plant Quarantine. Periodic inspections are made by the staffs of the district offices of such phases of environmental sanitation as water supply, sewage disposal, garbage disposal, dairies and pasteurization plants, and insect and rodent control, as well as eating facilities. Recommendations for improvements are discussed with resident supervisors and are included in written reports to the appropriate agencies. In addition, courses of instruction are given for the food handlers at these institutions. A similar service has recently been inaugurated for the hospitals of the Public Health Service. Furthermore, sanitary engineer and sanitarian officers are assigned to full-time duty with other Federal agencies including UNNRA, FPHA, FHA, Veterans Emergency Housing Program, Pan American Sanitary Bureau, Office of Labor of the Production and Marketing Administration, and Bureau of Prisons.

Finally, a few words concerning the only food sanitation activity with which the Public Health Service is legally charged—the supervision of interstate carriers. This program is authorized by the Public Health Service Act (Public Law 410 of 7-1-44), and the Interstate Quarantine Regulations which are now under revision in accordance with this Act. Its purpose is to protect the health of interstate travelers and prevent the spread of disease from

one state to another. Periodic inspections are made of sources of water, milk, shellfish, and other food served on vehicles of railways, airlines, and vessel companies engaged in interstate traffic, as well as methods of handling in dining cars, galleys, coaches and commissaries. Sources are either approved, provisionally approved for a limited period pending correction of substandard conditions, or prohibited. Many courses of instruction have been organized for food handlers employed by the carriers. Supervision of this activity is divided among the Land and Air Carrier Section, the Vessel Sanitation Section, and the Milk and Food Section of the Sanitary Engineering Division at Washington and the district offices in the field. Owing to its limited staff, however, the Public Health Service could not begin to do justice to this

program without the active cooperation of the several state health departments.

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Processing Plant Sanitation Conference *

The Department of Horticulture, Virginia Polytechnic Institute, is charged by the state of Virginia with the responsibility of initiating research within the field of fruit and vegetable processing. Eventually course work may be offered that will enable students to obtain specialized training within the field of fruit and vegetable processing.

It was with this idea in mind that the Department took the initiative, with the cooperation of other departments of the Virginia Polytechnic Institute, the National Canners' Association, the State Department of Agriculture, and the U. S. Food and Drug Administration, to provide the program scheduled below.

Canning Plant Sanitation Problems, by N. H. SANBORN, National Canners Research Laboratory, Washington, D. C.

Food Plant Sanitation, by ALLEN RETZLAFF, Chief, Baltimore Station, U. S. Food & Drug Administration, Baltimore

Cleaning Canning Factory Equipment, by C. W. BOHRER, National Canners Association, Research Laboratories, 1739 H Street, N.W., Washington 6, D. C.

Control of Flying and Crawling Insects in Processing Plants, by G. W. UNDERHILL, Associate Entomologist, Virginia Agricultural Experiment Station

Spray With DDT to Control Flies, by J. O. ROWELL, Entomologist, V.P.I.

Rodent Control in Processing Plants, by GEORGE B. LAY, Rodent Control, Fish and Wildlife Service, Boston, Mass.

Ventilation in Processing Plants and Prevention of Condensation, by P. B. POTTER, Agricultural Engineer, V.P.I.

Good Plant Keeping, by C. W. HOLDAWAY, Head, Department of Dairy Husbandry, V.P.I.

What the State Department of Agriculture Can Do to Aid in the Plant Sanitation Program, by S. S. SMITH, Director, Division of Dairy & Foods, V.P.I.

Canning Factory Wastes and Methods of Disposal, by N. H. SANBORN, National Canners Research Laboratory, Washington, D. C.

The above papers have been prepared in mimeograph form and can be secured by writing to Professor E. L. Overholser, Department of Horticulture, V.P.I., Blacksburg, Virginia.

* Conference held at the Virginia Polytechnic Institute, Blacksburg, Virginia, April 4-5, 1946.

Safety Factors of H. T. S. T. Pasteurizers*

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HIGH temperature pasteurization of milk with little or no holding time first came into practice between 1890 and 1900. Critical appraisals of the equipment then in use revealed that there were extreme variations in the temperature to which the milk was subjected. The time at which it was held was so short that it was referred to as the "flash" method of pasteurization. It proved to be only a "flash in the pan" and was soon condemned and discarded because of the lack of control, both of the temperature and time of heat treatment.

Technological advancements in instrumentation and automatic controls during and immediately following World War I gave new life to this method of pasteurization. Studies of the thermal destruction of pathogenic organisms showed that a temperature of somewhat less than 160° F. for several seconds would render milk safe. Between 1925 and 1932, health department officials and representatives of Colleges tested the various manufacturers' designs to ascertain whether under commercial conditions artificially infected milk would be rendered non-infectious.

Every conceivable abnormal stress which might occur under commercial operating conditions was placed on the machines and controls to see whether they would fail under load. These studies convinced many health officials that this method with this equipment was a relatively safe way of pasteurizing milk. Standards were adopted

which specified that every particle shall be heated to 160° F. or higher and that every particle shall be held continuously for 15 seconds or longer.

HOLDING TIME

From the time of sanction of this method of pasteurization up to World War II, there was a slow but gradual increase in the number of units placed in commercial use. The economic advantages of this method in the saving of material, space and labor placed it in great demand during the War and it will be some time before the present demand can be met. Because much of our milk and some of our milk products will be pasteurized by this method in the immediate future, it is wise to appraise again the equipment and methods of operation. If there are any short-comings they should be pointed out to the designers and instrument makers who, I am sure, will do all they can to improve the condition. Neither the equipment nor the operator will ever be fool-proof. Recognizing these short-comings, the legal holding time was set with a large safety factor as possible without undue injury to the product.

In Chart 1, I have attempted to depict the safety zone of the holding time and the factors which tend to narrow this zone. On the left hand side of this chart is shown the holding time necessary to sterilize pathogenic microorganisms. By sterilization is meant the inability to produce evidence of infection in test animals or evidence of growth in culture media under the particular conditions that the tests were performed. The most direct approach

* Presented at the thirty-third annual meeting of the INTERNATIONAL ASSOCIATION OF MILK SANITARIANS, Atlantic City, N. J., October 24-26, 1946.

to the problem are studies on commercially operated pasteurizers. During the summer of 1927 the United States Public Health Service, the New York City Department of Health, and the New York State Department of Health (1) jointly undertook to determine whether pathogenic microorganisms would be rendered sterile when added to milk and pasteurized in a high temperature, short time Electropure pasteurizer. The raw milk was inoculated with 10,000 or more minimum lethal dose of a mixture of bovine and human strains of *E. Tuberculosis*. Not a single sample of this infected milk after being heated to 158° F. and collected at the outlet of the heater caused evidence of infection in the test animals. The sampling point was at the entrance to the holding chamber but was a short distance from the outlet of the heater resulting in a calculated holding time of 2.2 to 3.7 seconds. This is shown on the Chart 1-A as a 3.7 seconds holding time but it should be remembered that the temperature was only 158° F. and samples were not taken at a shorter holding time. Similar results were obtained by all three participating laboratories and the number of test animals was the largest ever used in such studies. Other test organisms including *B. typhosis* and hemolytic streptococci isolated from human infections were never recovered when the milk was heated to 158° F. and the samples collected at the entrance to the holder.

During 1931 the Pennsylvania Department of Health in cooperation with the United States Public Health Service and the New York State Department of Health undertook a similar study but used a York water-heated type of pasteurizer (2). The raw milk was inoculated with from 20,000 to 200,000 minimum lethal dose of a mixture of bovine and human strains of *E. Tuberculosis*. Not a single sample of this infected milk after being heated to 152° F. or higher and collected at the outlet of the heater caused evidence of

infection in the test animals. Although the holding time at this sampling point is not given, it was probably infinitesimal as the milk passed from the final heater directly to a plate holder.

Pathogenic streptococci required more heat treatment to render them sterile. However, at the shortest holding time tested, namely 6 seconds and at a 160.8° F., all samples were negative (Chart 1-B). From this study a holding time less than 6 seconds is sufficient to sterilize streptococci but the actual time necessary was not determined.

Previous work (3) with an early model Electropure pasteurizer in operation at Michigan Agricultural Experiment Station, Massachusetts Institute of Technology, and at a commercial milk plant at Pittsburgh, Pa., showed that *E. Tuberculosis*, *Br. melitensis*, *B. typhosis* and pathogenic streptococci were sterilized in milk heated to 155° F. or higher. Holding times were not given but samples were taken at the outlet of the holder. Organizations represented in these studies were the Michigan Agricultural Experiment Station, Michigan State College, Michigan State Department of Health, Cornell University, University of Pittsburgh, Massachusetts Institute of Technology, and the Public Health Council State of New York.

There are many reports in the literature of thermal destruction of pathogenic microorganisms in milk under laboratory conditions but in no instance has the required minimum holding time at 160° F. been determined. The reason for this was the difficulty of sampling in this short period of time. North and Park (4), working with *E. Tuberculosis*, used holding times as short as 10 seconds but at 160° F., the shortest time tested was 20 seconds, and all samples were non-infectious to test animals. Curves of the time, temperature combinations necessary to sterilize organisms at the longer time—lower temperature findings have been extended to the higher temperature

range. These extended curves are probably in error unless the thermal treatment received during the critical heating period is properly assayed. As the temperature is raised and the time shortened the percent of treatment during heating and cooling becomes progressively greater. Laboratory equipment developed recently for automatic sampling under electrical time control should aid materially in obtaining more precise results (5).

On Chart 1 we see that the necessary holding time is never more than 6 seconds and it is actually something less than this but the exact time has not been ascertained. With a required holding time of 15 seconds we have a safety zone of 9 seconds in time. The importance of a safety zone is not how large it is but what are the probabilities and possibilities that this zone will be invaded and to what extent.

FACTORS WHICH AFFECT UNDER-HOLDING

On the right hand side of Chart 1 are shown factors which affect under-holding. The electrical conductivity test of a salt solution has come into general use as a means of determining the holding time of a liquid in motion. It is assumed that the salt travels in a manner identical to every particle of the solution being tested, and that the first particle of salt is detected as it reaches an electrode. Neither of these assumptions has been proven. An electrolyte in solution is molecularly active and therefore some of the salt particles may move faster than the solvent. On the other hand neither the electrode nor the potentiometer are sensitive enough to detect the first particle of salt. The sensitivity of these instruments may be and probably is satisfactory for all practical purposes but the accuracy of the test method is unknown and is shown as a "?" on Chart 1-C. A study proposed by the committee on sanitary procedure of this Association and sponsored by the National Sanitation Foundation should yield the an-

swer to this and other questions of holding time determinations.

The technique of performing a test will affect the results obtained. An error will occur in human timing particularly when trying to read in fractions of a second. Pay and Fraser (6) using an automatic timer report a maximum variation of 0.60 second and a negative deviation of 0.38 second from the average. (Chart 1-D.) Comparable manual timing gave a maximum variation of 1.0 second and a negative deviation of 0.68 second from the average (Chart 1-E). It should be noted, however, that the average of manual timing was 0.2 second shorter than the average of automatic timing. These findings are confirmed by many observations and I feel sure that any experienced tester can consistently obtain readings with a range not greater than 1 second.

The amount and concentration of salt solution used, the direction of injection, whether with the flow, across the flow, or against the flow, and the electrical detector used, whether a galvanometer, milliammeter, or solu-bridge, will cause slight variations in the readings. In the few instances where I have had an opportunity to check the effect of these variables, the final average readings have never varied more than 1 second (Chart 1-F). In one instance, the unit was first timed by injecting 100 ml. of salt solution with the flow and using a galvanometer as the detecting instrument, followed by injecting only 5 ml. of salt solution across the flow and using a solu-bridge as the detecting instrument. There was only 0.2 second difference of the average of 10 readings under each condition with the shorter holding being obtained by the latter technique. The galvanometer and solu-bridge were compared under identical conditions and the difference in readings was immeasurable.

Now let us assume that the test is accurate, until evidence to the contrary is obtained, and the average holding time is found to be 15 seconds. If the

maximum negative deviation is 1.0 second and if this should happen to be the correct timing, then the legal safety zone would be invaded by 1.0 second. But we should still have a safety zone of 8 seconds which is more than half the required holding time. If the holding time was set at 16 seconds or more, as is usually done in commercial operation, inaccuracies of the test would not result in invasion of the legal safety zone.

The flow in the holding chamber will not always remain exactly as it was at the time of testing. We are primarily interested in those factors which may result in a shortening of the holding time. Regulations specify that a holding tube shall have an upward slope in the direction of flow. Occasionally the holding tube supports are not permanently fixed resulting in a variable slope of the holding tube depending upon how it is assembled. If the slope in the direction of flow is downward in any part of a holding tube, air will be entrapped and the effective liquid flow capacity will be decreased. With a constant machine capacity, a decrease in effective volume of the holding tube results in a shortening of the holding time. The maximum reduction in the holding time due to this defect that I have ever found has been 2 seconds (Chart 1-G). Quite often a reducer is located at the downstream end of the holding tube. If the reducer is located at the bottom of a horizontal pipe, air may be entrapped and result in a slight shortening of the holding time.

An increase in pump speed or a decrease in pump load will result in an increase in volume, and with a constant holding chamber the time of holding will be shortened. Many pumps used on these units are driven by means of a variable speed V-belt and pulley arrangement. Some of the older models of these drives were so designed that either wear or stretching of the belt resulted in an increase in pump speed. The maximum reported reduction in

the holding time due to this defect is 5 seconds (Chart 1-K) and in the few instances where such drives were used, the reduction in holding time was usually very small, particularly if inspections were made frequently.

Wear of a pump invariably results in a decrease in capacity and a corresponding lengthening of the holding time. However, in one instance, I encountered an increase in capacity over a previous timing. Upon investigation it was found that at the time of the first timing two paper gaskets were used on the head assembly and at the time of the second test only one gasket was used. Two gaskets increased the impellor clearance and allowed more slippage. At the first test the holding time was set at 16 seconds and at the second test the holding time was found to be 14 seconds. Variations in the thickness of gaskets could affect the pump capacity but so far as I know the variation in gasket thickness in common use has not resulted in a detectable difference in holding time.

The speed of the electric motor drive of a pump may vary due to changes in line voltage. Electric motor manufacturers report that variation in line voltage will not cause more than a 5 percent variation in motor speed and this is equivalent to a variation in holding time of 0.65 second. The tendency is for the voltage and the motor speed to drop resulting in over-holding. It is advisable to check the speed of the motor and pump at the time of testing.

At first appearance it would seem that the pump load is constant. Actually the pump load varies almost continually but the variations are all small. First the static head in a so-called constant level tank is not constant, particularly if the level control is of the high and low type such as a Faratron. If timing is done with a maximum head any later variations result in over-holding. Leaks on the suction side of the pump will cause changes in capacity. Therefore, you should be certain that there are no leaks

at the time of testing, and any leaks developing thereafter will result in over-holding. Any leak on the discharge side of the pump will lower the pump load. Any leak, including an open valve or fitting, would not be greater than completely disconnecting the unit beyond the flow diversion valve. Therefore, an open diversion line is equivalent to the maximum leak possible. The largest shortening of the holding time during diversion flow over forward flow that I have found was 4.0 seconds (Chart 1-J). Theoretically a leak of this magnitude could occur but is improbable as the pasteurized milk would not pass through the regenerator and cooler, the milk would not be cooled, and the raw milk would not be heated. In practice, reduced holding due to leaks or opened valves probably never exceeds 1 second.

Pump load may be affected by changes in line resistance but here again the resistance usually increases and the holding time is lengthened. Accumulation of milk solids on plates is an example of this condition. Lowering of the pressure on the heating side of the heater section or cooling side of the cooler section may permit the plates to bend and widen the milk zone. In one instance where both the hot water pressure and the brine pressure dropped, the rate of flow in the milk zone increased and the holding time was shortened by about 2 seconds. This was an unusual condition because of the fact that the plates were of an old design. Little, if any, variations would be expected of modern plates.

Compression of plate gaskets increases pump load and lengthens the holding time. The installation of new gaskets may result in shortening the holding time slightly but probably never more than one second. Specific data on this point is not available.

All factors of holding discussed so far are predicated upon salt tests and pertain to operation with water. Milk and water have dissimilar physical properties which may be reflected in

the holding time. The positive type pump in common use when in good condition will pump about equal amounts of milk or water. The poorer the condition of the pump the greater will be the difference in capacity for the two liquids, the efficiency being in favor of milk. Table 1 shows the relation of water to milk capacity of several

TABLE 1
PUMP CAPACITY, WATER VS. MILK

Unit No.	Pump Capacity in G.P.M.		Percent Increase Milk Over Water	Calcu- lated* Holding Time
	Water	Milk		
1	27.1	28.8	7.0	14.0
2	33.7	33.9	0.5	14.9
3	33.9	33.9	0.0	15.0
4	34.1	36.1	5.9	14.1
5	38.0	38.0	0.0	15.0
6	2.4	2.5	4.2	14.4
7	2.5	2.8	12.0	13.2
8	27.0	28.6	5.9	14.1
9	2.0	2.5	25.0	11.2
10	13.3	14.1	6.0	14.1

* Calculations based on the assumption that the holding time for water was 15 seconds.

pumps in operation on commercial units. In every instance the pump delivered an equal or greater quantity of milk than water, the largest difference being 25.0 percent. If the holding time for water operation was 15 seconds the holding time on milk operation would be 11.2 seconds (Chart 1-H). This may not be the largest difference existing at any time. The difference in pump capacity for water and milk may be significant so all units should be tested for milk capacity.

It is conceivable that the difference in physical properties between milk and water such as viscosity and specific gravity would be reflected in the flow characteristics of the two liquids. Some light was thrown on this problem in a study of high temperature, short time pasteurizers in New York City (6). Table 2 gives the comparable holding times for four units in which the pump capacity was identical for both water

TABLE 2
MILK FLOW VS. WATER FLOW HOLDING TIME

Unit No.	Average Time Per 10 Gallons		Quantity Injected	Ind. Thermometer Av. Holding Time		Difference Milk over Water	Rec. Therm. Av. Holding Time		Difference Milk over Water
	Water	Milk		Water	Milk		Water	Milk	
1	15.8	15.8	50	17.6	18.3	+0.7	17.7	18.3	+0.6
	15.8	15.8	100	17.3	18.1	+0.8	17.3	18.2	+0.9
	15.8	15.8	150	17.5	18.0	+0.5	17.6	17.9	+0.3
2	17.7	17.7	50				16.2	15.8	-0.4
	17.7	17.7	100	19.0	20.0	+1.0	15.6	15.5	-0.1
	17.7	17.7	150	18.6	19.0	+0.4	15.8	15.3	-0.5
3	17.7	17.7	100	18.2	18.0	-0.2	16.4	17.2	+0.8
	17.7	17.7	150	17.7	18.0	+0.3	16.0	16.6	+0.6
4	17.8	17.7	50	16.8	17.0	+0.2			
	17.8	17.7	100	16.5	16.7	+0.2	17.2	16.1	-1.1
	17.8	17.7	150	16.4	16.5	+0.1	17.0	16.0	-1.0
Incidents that holding time of milk was longer							9	5	
Incidents that holding time of milk was shorter							1	5	

and milk. During water runs the holding time was determined by injecting cold water and during milk runs the holding time was determined by injecting cold milk. The findings indicate that there is very little difference in the flow characteristics of water and milk. There appears to be less channeling of milk but the difference is so slight that it may be within the experimental error of the method used.

Finally let us look at the shortest holding time possible which could occur. Let us assume that we have a pump unit which will give a 15-second holding time when set at minimum speed. Now if the speed adjustment was changed either intentionally or accidentally to maximum speed, the holding time would be shortened proportionally. The high speed of the pump with a variable drive is about twice the low speed. In other words the holding time could be reduced to about 7.5 seconds (Chart 1-L) which is still outside the danger zone. In all probability the heating capacity of the unit would not be sufficient for this high volume and the thermal control would divert the flow. If the temperature could be

maintained the chances are that the milk could not be cooled properly and the packaging facilities would be overtaxed. A similar condition could exist if two or more pumps were operated simultaneously and this could occur when an homogenizer is installed in parallel with the timing pump. If an homogenizer and timing pump are installed in parallel they should be so electrically wired that they cannot be operated simultaneously.

You will note from Graph 1 that no single defect would shorten the holding time to the extent that it would enter the danger zone. With the holding time set at 16 seconds or more as is commonly done, it would be a rare occurrence to have a holding time of less than 15 seconds.

HOLDING TIME DETERMINATION

From the foregoing it can be seen that the holding time is not a constant. If we had an instrument which recorded the minimum holding time, the chart would show fluctuations similar to the chart of a temperature recorded. Such an instrument would be very welcome but there does not happen to be such

a gadget available. Recording flow meters are available but they only measure average flows and not the flow of the fastest particle which is what we are concerned with.

The salt test is a practical means of determining the minimum holding time when operating with water. It has the disadvantages that it is quite complicated and cannot be used directly on milk or milk products. It is not standardized and its accuracy is unknown.

A simple field test is needed which can be applied during routine inspections. The volume of milk being processed in a given length of time can be used as an indirect measure of the holding time. If the time to deliver a certain quantity of water, usually 10 gallons, is determined for a given holding time as measured by the salt test, then the time that an equal quantity of milk is processed can be used to calculate the holding time of milk. Under normal operating conditions this is a good, simple, and practical method of determining the holding time. However, this method will not detect certain abnormal conditions such as entrapped air in the holding chamber which may shorten the holding time. If for some reason a section of the holding chamber were removed it would not be detected by a volume flow test.

A hot or cold wave passed through the holder is another means of measuring the holding time. Several instrument companies have developed special automatic timers based on this principle. A thermal bulb is placed at each end of the holding chamber. These thermometers start and stop an electric timer or record the time on a fast moving chart. During normal temperature operation additional heat is supplied for a few seconds or the supply is cut off completely for a few seconds resulting in a temperature change wave. The main disadvantage of this method is that additional gadgets are needed. The sensitivity, accuracy, and dependability have not been ascertained.

Mr. H. L. Thomansen of the Indiana

State Board of Health has made use of this thermal principle in another way. In his method, a cold solution, either cold water or cold pasteurized or sterilized milk, is injected into the upstream end of the holder. As this cold wave passes the downstream end of the chamber the indicating and recording thermometers register a temperature drop. Mr. Thomansen (7) states, "In all cases the response of both the indicating and recording thermometers was excellent and the test's accuracy in comparison to known tests was demonstrated as shown in the above tables." The tables show that the indicating thermometer readings had a range of -1.0 second to $+2.0$ seconds and a mean deviation of $+0.37$ second when compared to the salt test. The recording thermometer readings had a range of -0.2 second to $+1.0$ second and a mean deviation of $+0.32$ second.

This method looked so promising that it was included in the survey of plants in New York City (8). Twenty pasteurizers were covered in the study. Cold inspections were made both with water operation and milk operation. At least thirty trials were made with each operation, ten trials for each of the three volumes used, namely 50, 100, and 150 ml. Multiple readings were made by two to five observers with a total of over 2,000 individual readings. The holding time as determined by this cold injection method was always longer than the holding time by salt test when run simultaneously. Cold salt solution was used as the test medium in these comparative trials. The holding time of cold injection was always longer than the salt test time (Table 3). Both in this study and the study by Thomansen the salt conductivity test was used as the control, but as the salt test is not standardized the studies are not directly comparable. The longer holding time obtained by the cold injection test does not necessarily bar the method. If the correction factor for true holding is constant then the true holding time can be calculated.

TABLE 3
COLD INJECTION TESTS VS. SALT TEST

Volume Injected ml.	Indicating Thermometer		Recording Thermometer	
	Extreme Deviation *	Average Deviation *	Extreme Deviation *	Average Deviation *
50	+1.4-+5.2	+2.8	+1.1-+3.5	+2.2
100	+1.6-+5.0	+2.6	+1.3-+2.8	+1.9
150	+1.0-+4.6	+2.4	+0.8-+3.7	+1.8

* Salt Test used as control.

From these preliminary studies it appears that the correction factor is fairly constant for each unit but varies for different units. This is to be expected as the sensitivity and response of thermometers vary.

This method has the advantage that it can be made any time during commercial pasteurization of milk or milk products. It is simple to perform with the exception that the temperature change of the thermometers is not sharply defined. It has an auxiliary value in that it may show up defects in sensitivity of the thermal limit controller and response of the flow diversion valve when these instruments are not tested independently. The method should be questioned from a safety standpoint. The product injected may be safe but because it is cold, it will lower the temperature of the adjacent product being pasteurized both by conduction and mixing. If the thermal control is not sensitive enough—and it probably is not as I will try to show later—a small quantity of sub-legal temperature milk will pass into the pasteurized milk zone. The only auxiliary equipment needed is a syringe and an injection cock. The ones we are using are shown in Plate I and are made of standard sanitary milk piping and fittings.

CONCLUSION

From the information available milk heated to 160° F. and held for 6 seconds or less is sufficient to sterilize pathogenic organisms associated with milk. A 15 seconds holding time assures a safety zone of 9 seconds or more. When the holding period is

timed at 16 seconds or longer, as it usually is on commercially operated units, the actual minimum holding time will seldom be less than 15 seconds. Under the most extreme adverse condition possible, the minimum holding time approaches the theoretical danger zone, but probably never enters this zone.

TEMPERATURE

Automatic temperature controls have two functions: to maintain the desired temperature of the milk, and to stop the flow when the temperature is below the legal standard. We, as health sanitarians, are primarily interested in the second function. If the instrument does not detect sub-legal temperatures or fails to respond properly upon such a detection, the milk temperature will fall below the legal standard and may drop within the danger zone.

In Chart II, I have attempted to portray graphically the safety zone when the temperature is 160° F. and the factors which tend to narrow this zone. Again, taking the results of various studies (1, 2 and 3), we find that a temperature of 155° F. with a holding time of 15 seconds is sufficient to sterilize *E. Tuberculosis*, *Br. melitensis*, *B. typhosus*, and pathogenic streptococci when pasteurized in milk in commercial units. In most of these studies, the next lower temperature used was 150° F. and at this temperature only an occasional sample showed the presence of viable test organisms. In the few studies in which an intermediate temperature was used, it was found that 151.8° F. was adequate. In Graph A of Chart II, the temperature required to sterilize patho-

gens is shown as 155° F. From the data available this could be lowered to 151.8° F. but until we have further confirmation, I have been conservative and used the higher figure.

FACTORS WHICH AFFECT SUB-LEGAL TEMPERATURE

The graph on a recording thermometer chart is such a pretty picture that we are apt to accept it as a true reading without question. Actually the reading of a thermometer is never accurate during a change in temperature of the medium being measured. This can be demonstrated emphatically by immersing a cold bulb in hot water of a known temperature for a few seconds and then removing it. The thermometer reading will rise rapidly at first with a gradual slowing down, but it will not reach the true temperature. The same is true when the bulb is stationary and a medium of changing temperature passes around it. This is due to the fact that it takes time for heat to flow to or from the bulb and it takes time to translate the energy into measurable movement. The first is spoken of as the "response" and the second as the "sensitivity" of the instrument.

When the temperature in the holding chamber drops, the controller attempts to flow this change but lags behind both in temperature and time. The faster the change the greater the lag will be. Under what condition will the fastest drop in temperature be encountered? Shutting off the source of heat. In a hot water system this would occur with a failure of the hot water pump. The rate of drop under this condition would average about 0.5° F. per second and may approach 1.0° F. per second (9). The rate of drop would probably be greater when electricity is used for direct heating. Under this extreme condition the average thermal controller used on most units would lag behind the true temperature, about 0.5° F. and 3 seconds in time. (Chart II B.) If the bulb of the controller is located within a

distance of the flow stop, which is less than the distance the fastest particle will travel in 3 seconds, sub-temperature milk will pass forward. An even worse condition is a rapid fall to just below the set point and then remaining steady or rising quickly. The controller would not respond to this low point and diversion would not take place.

It would seem logical to correct this defect by using a more responsive thermometer or by locating the bulb farther upstream from the flow stop. This would be a step in the right direction for descending temperatures but would be a step in the wrong direction for ascending temperatures. Under conditions of a rapid rise in temperature, the thermal controller should not actuate the flow diversion valve until all sub-temperature milk has passed out of the holding chamber and diversion valve. A rapid response on descent and a slow response on ascent may be desirable but is not a characteristic of a thermal instrument. One possible way to improve this condition would be to set the cut-in point of the controller a degree or more higher than the cut-out point. A second possibility would be to use two thermal bulbs, wired in series, with one located at the entrance, and the other as close as possible to the exit of the holder. This arrangement would give the advantage of a double safety feature but the disadvantage of an extra instrument to care for.

The sensitivity of the instrument is not simply a function of the thermometer. You all know that a thermometer responds faster in water than in air, and faster if the medium is agitated rather than quiescent. Coating of the bulb with milk solids will decrease its rate of response. Each of these conditions can and do occur in commercial units. During the study of holding time by the cold milk injection method, previously mentioned, several instances were encountered where the thermometer failed entirely to respond to the sudden temperature change. Upon in-

vestigation it was found that entrapped air or foam surrounded the bulb. This is shown on Chart II D as 1° F. which is only an approximation. With the controller located out of the liquid flow stream a considerable quantity of sub-temperature milk may pass forward. When the bulb is located in the flow stream, a forward flow may occur before foam at the upper edge of the holder reaches the legal temperature. With the use of a glass holding tube, it is obvious that there is always more or less foam present and this foam moves at a slower rate than the liquid.

The forward flow of milk may be stopped either by means of a pump stop or a combined pump stop and flow diversion valve. In each case there is a time lag. Diversion valves are designed to respond in less than 1 second but in commercial operation they are occasionally slower due to stem friction or excessive spring tension at the leak protector ball ports. This lag is accumulative with the thermal lag and may amount to as much as 1.75° F. (Chart II E.) Therefore, with a descending temperature, the control bulb should be located at least as far upstream from the valve as the distance the slowest moving particle will travel in 1.75 seconds, but, again this would be the improper location for an ascending temperature.

A critical examination of the valve action will show that at a cut-out, forward flow is not stopped until the stroke is completed. But upon cut-in, forward flow is permitted at the beginning of the stroke. This is just the reverse of what is desired. The valve should respond as rapidly as possible on cut-out but a lag on cut-in would be advantageous. This could be accomplished with a delayed action switch or by the use of a second control bulb at the upstream end of the holder as previously mentioned.

A sluggish controller or valve may result in sub-temperature milk entering the pasteurized milk zone but probably in no case would this drop in tempera-

ture be sufficient to reach the danger zone. A defective instrument or valve is another thing. If a switch fails to open when the controller descends below the set point, forward flow will continue regardless of how low the temperature falls. (Chart II F.) Such failures are rare but they do occur occasionally. In one such instance, we found that a screw had loosened and shorted the thermal contact switch. In another instance, the contact points stuck, apparently due to excessive pitting. While testing a new installation we found that the valve remained in the forward flow position until the temperature reached 160° F. when it diverted. The electrical wiring had been unintentionally reversed. Occasionally the defect is intentional upon the part of an operator and, therefore, inexcusable. A good instrument may be improperly adjusted due to the use of an inaccurate test thermometer or faulty testing technic. Instruments in use do get out of adjustment and, therefore, should be tested and serviced frequently. Major defects usually are on the safe side. A leak in the tube system or air pressure failure of an air actuated control system results in a rise in the setting.

Most flow diversion valves are designed with several safety features. If the valve fails to assume the diversion position when the temperature is below the setting, the electric circuit to the milk pump is not closed and the unit does not operate. However, if the micro-switch sticks in a closed position or is shorted, milk at any temperature can flow forward. (Chart II G.) The valves seldom fail to approach the closed position but frequently fails to close tight enough to prevent leakage forward. One reason for this is that the maximum load is on the power unit at this point and the power spring is under the last tension. Not only does the valve have to be removed, but the spring tension of the leak ports must be increased to open. This defect occurs so frequently that many micro-

switches are set to close before the valve is fully closed. This defeats the major purpose of the micro-switch.

The micro-switch on some valves is designed to close the pump circuit under positive action of the valve or clip key and to open under spring action. If this action was reversed, then a sticking switch would be on the side of safety. Apparently, these switches are not rugged enough for the purpose or are not properly protected for they frequently become shorted or remain in a closed position.

In all of these valves, safety is placed on a leak protected valve seat. Experience has demonstrated that it is not fool-proof. New valves will soon be on the market (at least one is on display at this show*) in which safety is placed on the difference in hydraulic pressures in the forward and diversion lines. The diversion port and line are sufficiently large to accommodate the maximum flow without creating pressure and, therefore, flow through the forward port. Such a valve will have the added advantage that any sub-temperature milk having passed the valve for a short distance, due to slowness of response of the controller, can be recalled and diverted. The safety of many of the valves now in use can be improved by removing restrictions from the diversion lines. To prevent leakage through the forward port during periods of diversion, the valve is designed with a double seat and a leak protector groove between these seats. There are two ball valve ports on the leak groove which are closed during forward flow and open during diversion flow. These safety valves often leak so badly when closed that the operators seal them shut in one way or another. This defeats the purpose for which they are intended. There is also an opening through the core of the valve which is not protected against leakage of sub-temperature milk and leakage at this point has been ob-

served. Proper hydraulic conditions within the valve would correct each of these defects.

Another condition which may result in sub-legal temperature milk is the operation of the unit without operating the automatically controlled timing pump. An homogenizer used as a pump is not stopped by the safety switches of the flow diversion valve or the thermal controller when they come into play, unless it is properly wired to these safety devices. Many units are not so wired and under this condition, if the flow stop becomes defective, milk at any temperature can flow forward. A similar condition can occur if the head pressure of the raw milk is greater than the head pressure at the forward flow port of the holder outlet.

CONCLUSION

The thermal control instruments in use have a time and temperature lag to temperature changes. The deviation from true temperature probably never is more than 1° F. and if the controller is set 1° F. above the legal requirement, as is usually done, sub-legal temperatures will rarely result. The thermal instruments and the safety devices which they control may be defective due to faulty installation, adjustment, or operation. This is one defect which may result in traversing the safety zone and entering the danger zone of temperature. The dependability of the instruments should be improved. The operator and inspector should inspect and test frequently and thoroughly those in use.

TIME-TEMPERATURE COMBINED

Any one or more of the defects of time and any one or more of the defects of temperature may occur simultaneously. There is one other condition in which the time of holding is short and the temperature is low, namely, a leak in a milk-to-milk regenerator with the raw milk under higher pressure than the pasteurized milk. Although most units are set up with the positive type pump located between the regenerator

* Dairy Industries Exposition, Atlantic City, N. J., October 21-26, 1946.

and the heater, and the raw milk forced through the regenerator under sub-atmospheric pressure, occasionally a pump is located upstream from the regenerator. On large units a relatively high vacuum is necessary at the suction side of the timing pump which makes practical operation difficult. To overcome this difficulty a centrifugal type pump called a "booster" is installed at the entrance to the raw regenerative section. Such a pump develops a positive pressure in the raw milk section of the regenerator, and as there are conditions in which there is only atmospheric pressure on the pasteurized side, a leak through the milk-to-milk surface would permit under-heated and unheld milk to flow into the pasteurized zone. Such leaks are rare but they have occurred and when they do the purpose of pasteurization is completely defeated.

It would seem logical to try to avoid a positive pressure in the raw milk regenerative section by not creating pressure. If this is not possible with large existing units, appropriate safety features should be provided. A pressure actuated switch has been developed for this purpose and is installed at the outlet of the pasteurized side of the regenerator. The pressure switch is set and wired so that it will close the circuit to the booster pump only when the pressure at the switch location is higher than the maximum pressure developed by the booster pump. If the pressure switch is properly adjusted and maintains its setting, there should be no danger of raw milk being bypassed even if a leak should develop. However, the first switches developed have not all been rugged enough to stand up under daily plant use but improvements are under way. In anticipation of possible failure of the pressure switch, the circuit to the booster pump is also wired through the thermal limit switch. With this arrangement and with a failure of the pressure switch, there would only be rare conditions under which the pressure in the regenerator would be unsatisfactory, and

to be dangerous they would have to occur simultaneously with a defective milk-to-milk surface.

When raw milk is being drawn through the regenerator by a positive or vacuum type pump and there is pressure on the pasteurized side of the regenerator, there is no danger of a raw milk by-pass even if there is an opening. However, if an empty unit is started and then stopped after the raw milk side has been filled and, before the pasteurized side is filled, there will be static head pressure on the raw side and only atmospheric pressure on the pasteurized side. An opening would permit leakage. To avoid this condition regenerators are designed with regular or auxiliary ports so that the raw milk will flow back to the supply tank at a lower head. However, during the period of back flow the raw milk is under a positive but diminishing pressure. If there was an opening, leakage could occur until the head dropped to the point of opening. Starting and filling the unit with water will eliminate the possibility of such a raw milk leakage.

CONCLUSION

Raw milk may by-pass the pasteurizer entirely through leakage of a defective milk to milk regenerator, if not properly designed and operated. This serious defect rarely occurs and can be avoided if the pasteurizer is so designed and operated that the raw milk is always under less pressure than the pressure on the pasteurized side of the regenerator.

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CHART I

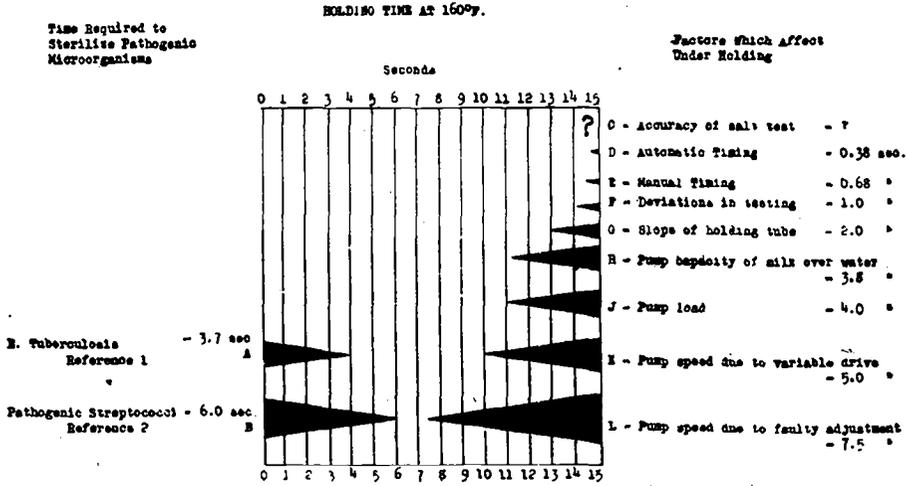
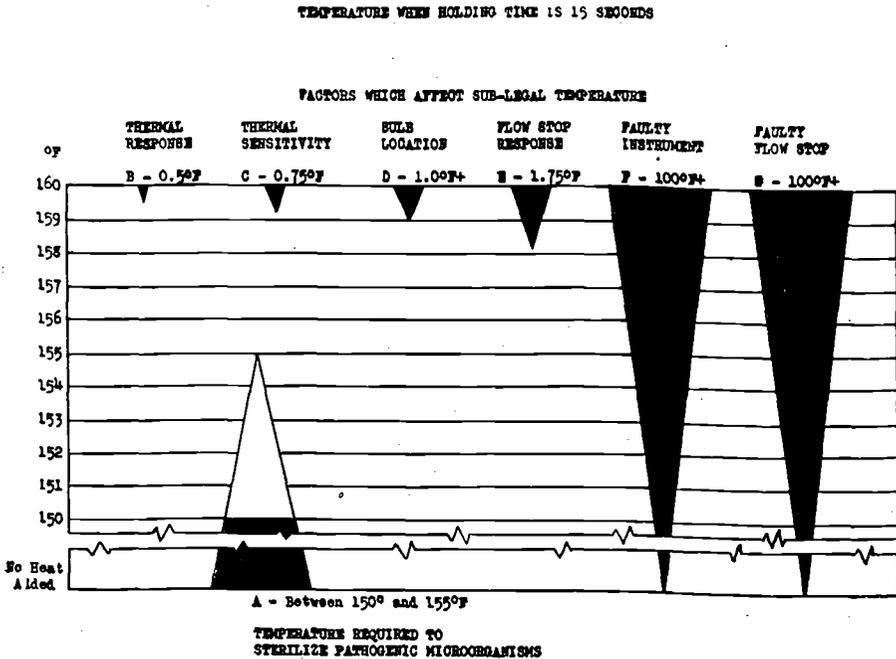


CHART II



(Continued on page 53)

A Survey of the Direct Microscopic Method of Examining Milk and Cream Samples in Approved and Registered Laboratories of Connecticut*

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SINCE October 1, 1945, a state law, Section 601h of the 1945 Supplement to the General Statutes, has provided for the registration and approval of dairy laboratories, both public health laboratories and those maintaining plant control, and for inspection by the State Department of Health. This law applies to all examinations, determinations or tests on milk, milk products, cream, and frozen desserts, and to the containers or packages in which these products are sold. All such laboratories must register with the Department, but a laboratory need not be approved so long as the results secured are used solely by the person, firm, or corporation operating it. A laboratory which reports results for use by any person, firm, or corporation other than the one maintaining the laboratory must hold an unexpired certificate of approval issued by the Department. Certain specific exemptions are provided in the statute to prevent conflict with other laws.

During the last quarter of 1945 and the first quarter of 1946, inspection visits were made to eighteen approved and registered laboratories which include the direct microscopic method of examining milk and cream samples in their control program. The purpose of this series of visits was to determine the degree of uniformity, or lack of it,

with which this microscopic procedure is being carried on statewide in Connecticut laboratories. The laboratories visited were of three general types:

(1) Two registered laboratories and six approved laboratories operated by dairy plants for the control of their own products. Seven were using this method.

(2) Seven approved municipal and state laboratories, only five of which were using the direct microscopic method.

(3) Three privately operated approved laboratories only two of which were using the direct microscopic technic.

A report was made to the director of each laboratory visited giving in detail the findings for the laboratory and suggestions for improvement in performing the microscopic technic. A copy of the report was furnished in each instance to the laboratory or to the person in charge of the department of which the laboratory was a part, and a copy of each report was submitted to the State Dairy and Food Commissioner.

The reported number of examinations made in the 14 laboratories visited was 5,000 per month with a range for the individual laboratories of from 15 to 1,600 per month. These figures, as shown in Table 1, would seem to indicate that far greater use of this technic is desirable in local laboratories in Connecticut.

* Presented before the 58th Convention of The Connecticut Association of Dairy and Milk Inspectors, Fairfield, Connecticut, May 21, 1946.

TABLE 1
CONNECTICUT STATE DEPARTMENT OF HEALTH, BUREAU OF LABORATORIES
NUMBER OF DIRECT MICROSCOPIC EXAMINATIONS MADE AND DEVIATIONS FROM STANDARD
PROCEDURES IN 18 CONNECTICUT LABORATORIES

Class and Name of Laboratory and Identification	Number of Examinations per Month	1	2	3	4	5	6	7	8	9
		Unsterile Sampling	Unnecessary Sterile Technic	Storage of Pipette	Drying Smear More Than 5 Minutes	Slides Etched	Unapproved Stain	Unstand- ardized Microscope	Filing Slides	Reports Assuming Accuracy
Municipal and State Laboratories	1,985									
A	80									
B	90	x	x			x	x	x	x	x
C	15		x	x		x			x	x
I	*									
J	*									
M	1,600							x		
P	200		x	x	x					
Dairy Plant Laboratories	1,780									
D	30		x	x		x				
E	550		x	x			x			x
F	100	x	x	x			x			x
G	50	x	x	x		x	x		x	
H	781				x		x	x	x	
N	150		x	x			x			
Q	*									
R	120		x	x	x		x			x
Private Laboratories	1,260									
K	740				x	x			x	
L	520					x	x			
O	*									
Totals	5,025	3	9	8	4	6	8	3	5	5

* Technic not in use at time of visit.

Standard Methods for the Examination of Dairy Products, 8th edition, published by the American Public Health Association, and Approved Method MK4 of the Bureau of Laboratories, Connecticut State Department of Health, have been used as the basis for determining compliance of the laboratories with standard procedure. The Approved Method MK4 does not deviate from the standard method but

was designed to be more explicit in respect to the procedure to be followed. For example, although more than one staining technic is allowable in "Standard Methods" only one method is approved in order to encourage uniformity among these Connecticut laboratories.

The survey showed some deviation from standard procedure in every laboratory but one.

The deviations that were noted most commonly in this survey of laboratories are listed below, and are shown in Table 1:

1. Sampling by unsterile methods.
2. Unnecessary use of sterile technics in preparation of smears.
3. Pipette not stored in cleaning solution.
4. Drying period of milk smear longer than 5 minutes.
5. Slides not etched for permanent identification.
6. Use of an approved stain.
7. Microscope not standardized to workable field diameter.
8. Slides not filed for future reference.
9. Reports assume accuracy not inherent in method.

While it is a difficult matter to secure general agreement as to which deviations from a standardized technic are important and which play a minor role in the determination of the final results, those listed as numbers 1, 6, and 7 have been considered of primary importance in the determinations of the results. These major faults in technic were noted in 14 instances and relatively minor deviations from the recommended procedures accounted for the remaining 37 deviations.

Some of the minor variations in technic, though not adversely affecting results, do tend to make the work more burdensome and so may result in less extensive use of the method. An example of this is the tendency to use unnecessarily sterile practices in handling the pipette, loop, and milk smear spreader. Some of the persons carrying out the technic in the laboratories visited were even found to use sterile cloths for wiping the excess milk off the pipette.

The deviation listed as number 6 was one of those most commonly found in the survey. The *Standard Methods for the Examination of Dairy Products*, 8th edition, gives three formulas which may be used for preparing the stain. However, in Approved Method MK4 of the Connecticut State Depart-

ment of Health only one of these is approved for use in the laboratories of this state and therefore the use of other than carbolated methylene blue stain in the laboratories that were surveyed is considered a deviation. This stain¹ is described on page 53 of "Standard Methods". Another of the stains permitted in the 8th Edition, the single dip type of stain, is described in "Standard Methods" as "producing neither as clear nor as satisfactory preparations as when the steps are employed separately" and therefore its use is not acceptable in laboratories which are approved or registered by the Connecticut State Department of Health. The third stain, a modified Loeffler's formula, deteriorates rapidly and has not proved to be satisfactory.

The necessity for obtaining representative samples is considered a very essential step in the correct evaluation of a milk preparation and the use of unapproved sampling technics should not be tolerated. However, three laboratories were neglecting to see that the samples they were examining were collected in an approved manner. In some instances a Babcock milk sampling dipper was being used to collect samples for bacteriological analysis without even "practical" sterilization of the sampling device.

In three laboratories the microscopes used for examining the milk smears were not standardized to a known factor. In a few instances the deviation of the diameter of the microscopic field from one of the recommended diameters was so slight as to have little practical bearing on the results secured and these cases were disregarded.

The remaining six deviations from standard procedures, though of minor importance insofar as affecting the results obtained, should be eliminated from the technic of the laboratories in which they were found to occur, if

¹ Buck, T. C. Phenol Methylene Blue Stain. *Amer. J. Pub. Health*, 16, 1049 (1926).

The National Sanitation Foundation

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THE United States is the most sanitation-conscious nation in the world. As a result of this consciousness the dividends in health and welfare have been tremendous. Fulltime health departments are nearing the 2,000 mark. The death rate for typhoid fever, diarrhea, diphtheria, and other communicable diseases has been reduced more than 90 percent since 1900. The death rate for tuberculosis has been reduced 77 percent. Milk-borne epidemics are almost a thing of the past. Great progress has been made, and along with this development has been the growth of many businesses which credit their origin, expansion, and continued existence to sanitation.

Examples of these are the milk industry, the manufacturers of containers, cleansing and sterilizing agents, and equipment, the thousands of processors of foods and beverages, and a host of other industries and businesses that could never have attained present enormous proportions without the advance credited to sanitation.

However, acute knowledge of sanitation has not expanded as rapidly as the demands and the needs. The public needs and is demanding protection against unnecessary exposure to health hazards and disease. How can we, as health officials, meet this demand and further reduce our morbidity and mortality? What can we do to better the environmental conditions of the people of our own community? This is the challenge of today. How shall we meet it? It is obvious that the solution to

the many problems is not simple. The accurate knowledge to give this protection is not available. Therefore, the problem calls for an extension of current efforts. It calls for orderly and consistent efforts to increase knowledge through fundamental research and the dissemination of that knowledge through education.

The challenge to the health official is much greater today than it was forty years ago when he was faced with applying the then new knowledge of bacteriology and sanitary science to the purification of water and the pasteurization of milk.

There are still wider vistas and greater problems confronting the worker in the field of public health today, and more and more as we work with these problems in environmental sanitation, we are cognizant of the lack of accurate knowledge and the need for more fundamental data.

Within the last few years this recognized need for organized research and education in the field of environmental sanitation resulted in the creation of the National Sanitation Foundation. The purpose of this Foundation is as broad as the whole field of sanitation. It is an organization, supported by gifts, grants, and bequests, where public health workers, industry, and business may combine their efforts to solve common problems. The organization of the Foundation is designed to meet its purposes and needs. The Board of Trustees is composed of six members, four of whom are actively engaged in public health. The Board consists of the following: Mr. H. William Klare, Detroit; Judge Arthur J. Lacy, Detroit; Brig.-Gen. James S. Simmons,

* Presented at the Thirty-third Annual Convention of the INTERNATIONAL ASSOCIATION OF MILK SANITARIANS, Atlantic City, N. J., October 24-26, 1946.

Dean of School of Public Health, Harvard University; Dr. Nathan Sinai, Professor of Public Health, University of Michigan, *Vice-President*; Dr. Henry F. Vaughan, Dean of School of Public Health, University of Michigan, *President*; and Mr. Walter F. Snyder, *Secretary and Executive Director*. No sponsor is on the Board of Trustees. This Board has the responsibility of adopting policies and programs and approving grants of funds. There are two working committees; one on Technical Research, and one on Education.

The Committee on Technical Research is composed of leading scientists in the field of sanitation. Its membership consists of Mr. A. W. Fuchs, U. S. Public Health Service, Washington, D. C.; Dr. W. L. Mallmann, Michigan State College, East Lansing; and Mr. W. D. Tiedeman, New York State Department of Health, Albany—all names which are very familiar to the milk industry. Dr. Vaughan is chairman of this committee whose functions are to review requests for research grants, to prepare recommendations to the Board relative to the need and value of new research projects, to report the progress in sanitation research, and to serve as an agency for the integration of scientific knowledge in the field of sanitation.

The functions of the Committee on Education are comparable to those of the Committee on Technical Research. It prepares recommendations to the Board on research projects, analyzes the existing knowledge and materials of education, and serves as an agency to integrate and improve the methods of education in environmental sanitation and disseminate the results of the research of the Foundation. Very often in the past there has been a great lapse of time between the release of fundamental data at its source and the assimilation and application of this knowledge by the sanitarian in the field. Whatever are the results of basic research in the sanitary sciences and in education, their values will be deter-

mined through their application by the men in the field.

The Committee on Education consists of: Dr. Ira V. Hiscock, Yale University, New Haven; Dr. Margaret Mead, American Museum of Natural History, New York; and Lewis Dodson, University of Michigan. Dr. Sinai is chairman of this committee.

The approach of the National Sanitation Foundation is to eliminate the confusion and uncoordinated efforts by bringing together the leaders in the field of sanitation—men who know sanitation—and the leaders in the industries—the heads of industries. Thus we have an organization through which the responsible people of industry and sanitation come together to solve a common problem. To this end the Foundation has created a Consulting Committee on Sanitation. The membership of this committee is composed of outstanding personnel from over the nation in the field of environmental sanitation. The membership of this committee will be announced at the American Public Health Association Meeting in Cleveland, Ohio,* where they will hold their first annual meeting. This committee will provide much technical guidance in the development and application of uniform standards of sanitation based upon a scientific research.

Since the application of this basic research is also of great importance to industry and business, an Industrial Advisory Committee has been organized. This committee, which is composed of business men selected by the sponsoring members from their own group, meets at least twice each year.

The present list of sponsors includes manufacturers of soft drinks, detergents, glasswares, dishwashing machines, silverware and chain drug companies, breweries, restaurant asso-

* Dr. Herman G. Baity, Earnest Boyce, Joel I. Connolly, E. G. Eggert, V. M. Ehlers, F. B. Elder, W. A. Hardenbergh, W. R. Hardy, John M. Hepler, J. K. Hoskins, C. W. Klassen, W. Scott Johnson, Ferdinand A. Korff, R. E. Leaver, Walter S. Mangold, H. E. Miller, L. J. Peterson, Sol Pincus, M. Allen Pond, Charles L. Senn, H. A. Whittaker.

ciations, equipment manufacturers, and many others. This list by no means limits the potential support of the Foundation, and many new interests are being developed monthly.

The commitments for the 1945-46 programs are in various stages of development. As progress is made in such research projects, prompt publications will be made. Progress reports and results of some of the research will be revealed by members of the technical committee at the American Public Health Association next month.

The program to date includes: a study of the various sanitary codes, an analysis of sanitary practices by the health departments, a study of public opinion regarding sanitary practices, and a study of the various methods used in the education of food handlers. The technical projects include a time and temperature study of mechanical dishwashing, a critical review of the swab-rinse test as a method of measuring the end results of utensil sanitization, and a project to determine a reliable test for detergents, and how effectively a detergent will remove soil under practical working conditions. Another project is one concerning some of the many problems involved in the use of quarternary ammonium compounds.

Tests are under way to determine the bactericidal efficiency of the various quarternary ammonium compounds against milk-borne and food-borne pathogens (such as staphylococci and salmonellas) as well as against water-borne pathogens, and to determine the bactericidal efficiency of these compounds as compared to chlorine for the sanitization of milk and food utensils. Tests will also be made to determine the toxicity of these compounds, their keeping qualities, their corrosiveness and other problems as well as the development of a suitable field test for determining the concentrations used at dairies, in restaurants, etc. It is hoped that a single test applicable to all compounds in this group can be developed.

The technical projects include also another project of much interest to the milk industry. Since the development of the "high temperature-short time" process of milk pasteurization, there has existed a need for a standard method for determining the holding time in this type of pasteurizer. Until now no satisfactory method has been developed. The method most used, one with which most of you are familiar, is to introduce a salt solution into the flow of water up stream from the holding chamber. This is done by placing an electrode at each end of the chamber with the electrodes connected to a potentiometer. This test is unsatisfactory, not only due to the fact that it has to be conducted with water instead of milk during routine operation, but there are many other variables that enter into the test. The concentration and amount of salt solution, the point of introduction of the solution, the size and type of electrodes, and the sensitivity of the potentiometer are all varied by every tester. How much these variations in technique affect the accuracy of the test is not known, neither is there any information available of the relationship of the salt method of testing to the actual holding time of the various microorganisms that may be in the milk. This problem is one of interest to industry as well as health officials. Without this information industry cannot properly design the different units, nor can health officials give assurance that the units tested are safe from a public health standpoint.

The members of the Technical Committee of the National Sanitation Foundation, realizing the importance of this problem, recommended to the Board of Trustees that consideration be given to this research. As a result a grant has been made, and very shortly there will be under way at Cornell University a research project "to investigate present methods and to standardize a preferred method for determining the holding time of high temperature-short time pasteurizers."

Here again we find a condition that has long existed and one that is prevalent today. Here is a method, like many of our new and modern methods that being adopted by industry and various new units will be placed into operation as rapidly as they can be manufactured.

Many health officials will be called upon to pass judgment on this and other new equipment. Often these officials have had no experience with the equipment in question. Forced to make a decision without satisfactory information and with no place to turn for factual data, the sanitarian must base his recommendations upon opinions. We all know that opinions, however honest, are still opinions, and not altogether trustworthy.

So here again, as in other research that the National Sanitation Foundation is sponsoring, an effort is being made to determine the facts upon which to base recommendations that will be acceptable and usable by health officers and a guide to industry throughout the nation.

The purpose, the method and the organization of the Foundation are intended to increase and extend knowledge. But equally important, the Foundation serves as a common meeting ground where public health, industry,

and business meet to define and solve common issues in the interests of the public welfare.

The health worker in the field on environmental sanitation has in the Foundation a definite source to turn for the much needed answers to some of his many problems; also here is an organization that he can recommend to industry in their search for the answers to mutual questions.

The application of the available knowledge and sound public health practices have done much to aid the health worker toward his goal. In the National Sanitation Foundation health men have an additional tool to aid them in their endeavors.

Much progress has been made since the forming of the organization. The active enthusiastic support of the sanitation personnel of the nation and the continued participation of industries and business in sanitation will make far-reaching advances toward a mutual goal, a goal that in accordance with the articles of incorporation, is the first obligation of the Foundation, namely: "The educational, scientific and charitable purpose of promoting progress and betterment in environmental sanitation, health, and education of and for mankind."

A SURVEY OF THE DIRECT MICROSCOPIC METHOD OF EXAMINING MILK AND CREAM SAMPLES IN APPROVED AND REGISTERED LABORATORIES OF CONNECTICUT

(Continued from page 29)

those laboratories are to follow the recommended procedure.

SUMMARY

This survey of the work of the 14 approved and registered laboratories in Connecticut that make use of the direct microscopic method of examining milk indicates that this procedure is not followed uniformly in this state to

the extent desirable. The results of this study indicate that more effective use of this method would be attained if provisions were made for prompt following up of laboratory examinations by inspectors. This is particularly important since this method when properly used permits more rapid and more specifically directed follow up of undesirable conditions and practices than do other bacteriological methods of control.

1946 Annual Report of the Committee on Sanitary Procedure

A subcommittee, consisting of C. B. Dalzell, Capt. Harold Wainess, and C. W. Weber, Chairman, was named in the Spring of 1945, to draft a recommended procedure for testing High Temperature-Short-Time pasteurizing equipment, and instructions for avoiding arrangements or conditions which would tend to alter standardized holding times.

It early became apparent that as prerequisite to the accurate determination of the holding time is sensitive thermal instruments which are accurate. A tentative draft of a standard method for testing thermal instruments and controls was therefore prepared.

However, it has been concluded by the sub-committee that data on a number of the bases upon which the procedure for a standard test for holding time should be predicated are not available. Consequently, a suggested course of research was outlined and presented to the National Sanitation Foundation for consideration. The Foundation agreed to sponsor and finance such research, and the Dairy Department of Cornell University agreed to undertake the study, provided personnel qualified to carry on the technical phases of the investigation becomes available. The University school year having just recently begun, the status of the research project has not progressed beyond that point.

The sub-committee regrets to report that progress in this project has been no more rapid, but feels that it is imperative that procedure which the Committee ultimately proposes and recommends be founded upon data obtained with instruments built to a fixed standard, or which can be standardized by the users, so that all measurements are of comparable accuracy.

The current activities of the Committee on Sanitary Procedure are of a nature which makes prompt publication of its findings and decisions desirable. Accordingly, two such reports, covering the work of the Committee since the last Annual Meeting, have already been published.

Sectional drawings and tables of standard dimensions, of twenty-seven fittings for milk piping and processing equipment, which have been declared to comprise the current sanitary standards, were published in the January-February number of the *JOURNAL OF MILK TECHNOLOGY* (pp. 12-21). "Sanitary Standard for Storage Tanks for Milk and Milk Products" were published in the May-June, 1946, number of the *JOURNAL OF MILK TECHNOLOGY* (pp. 152-155).

It is to be noted that none of the Committee conclusions are published until mutual agreement has been reached among the three agencies which are collaborating in the establishment of sanitary standards. Items of equipment which conform to the published standards are, therefore, entitled and privileged to bear the "3-A" insignia (as shown by the accompanying design).



A number of members of the Association have visited the booth at the Dairy Industries Exposition, at which the joint objectives and activities of the Milk and Food Unit of the U. S. Public Health Service, the Sanitary Standards

Subcommittee of the Dairy Industry Committee, and the Committee on Sanitary Procedure of this Association, are being made known, by personal discussions by representatives of these three agencies, and by distribution of the folder, of which I hold a copy, and which is submitted as a part of this Report. Those in this audience who have not visited that booth are urged to do so before they leave Atlantic City.

This suggestion is advanced for two reasons: (a) that they may observe a striking example of the result of active collaboration, on a high plane of purpose and since endeavor, between milk control authorities and representatives of all branches of the dairy industry; and (b) that they may take note of the widespread interest in this matter of the establishment of standards for sanitation in the design and construction of milk-handling equipment which is being evinced by those who attend the Exposition. That booth and this project of this Committee is contributing to the repute of this Association in no small measure, and is developing for it a high degree of stature and respect.

Those who visit the booth should also note the display on dairy products waste disposal, which is a project of vital concern to the entire dairy industry, and of considerable interest to many milk sanitarians, in which the Sanitary Standards Subcommittee is taking an aggressive interest.

Those in possession of copies of this folder will have noted the list of dairy equipment for which sanitary standards are now being formulated. For the present, the joint-agencies are concerning themselves with the formulation of sanitary standards for only those types of equipment the use of which is common to all branches of the dairy industry. Ultimately, standards for equipment peculiar to the several branches will be considered.

The speaker has been a member of this Committee for a considerable number of years, and is in position to realize

and appreciate the time and effort devoted to the development of the sanitary standards established prior to 1944. It is no secret (for the records substantiate the admission) that the establishment of standards for a few fittings, intended primarily for use in fluid milk plants, constituted normal progress for a year. At that rate of progress, however, we and the dairy industry would be considerably more aged before sanitary standards would have been established for a respectable number of types of dairy equipment. These somewhat self-derogatory remarks about the past activity of this Committee are prefatory to the assertion that the comparatively rapid advancement which has been made since the last Annual Meeting has been due, very largely, to the thoroughness with which the Sanitary Standards Subcommittee of the D.I.C. conducts the preliminary studies preparatory to the formulation of tentative standards which are submitted to this Committee. Without detracting one iota from the credit due the active members of the Committee on Sanitary Procedure, the record would be incomplete without this acknowledgement of the vital part of the joint-program which is being played by the Sanitary Standards Subcommittee.

The members of the Committee have met twice in New York since the last Annual Meeting in Chicago. They have devoted thought and time to the tentative sanitary standards submitted to them. They have presented you, the membership of the Association, with Sanitary Standards for certain items of dairy equipment, and have fulfilled the function delegated to them by the Association. It is now your turn to recognize and fulfill your obligation, as members of the Association. Unless you, individually and collectively, adopt these standards as *your* guide in the acceptance of equipment installed in milk plants, ice cream factories, creameries, cheese plants, condensaries, and milk powder plants, over the sanitation of which you exercise control, you will

withhold from manufacturers and fabricators the incentive to conform to the standards established as the result of so much study and discussion. An objective of the development of these standards, secondary to sanitation but nevertheless vital to the success of the whole project, is the ultimate elimination from catalogs and inventories of fittings and equipment which does not conform to the established standards. The cooperation of all members of this Association is essential to the attainment of these two objectives.

Mr. Thomas J. Kullman, Bowman Dairy Company, Chicago, the chairman of the International Association of Milk Dealers' representatives on the Sanitary Standards Committee, in a report to the I.A.M.D. early this week, urged the members of that Association to demand that equipment they henceforth order conform to "3-A" Sanitary Standards. Mr. Fred E. Uetz, The Borden Company, New York, chairman of the International Association of Ice Cream Manufacturers' representatives on the Subcommittee, will make a similar appeal at the Saturday morning session of that Association. If we all support this movement earnestly and aggressively, it will gain such momentum and force as to sweep non-standard equipment out of the market.

This Association, as a corporate body, has another responsibility in connection with this project. It must assist in the control of potential misuse of the "3-A" insignia. It has been proposed that the National Association of Dairy Equipment Manufacturers undertake the policing of manufacturers

and fabricators. But, because of legal restrictions, that means of control, even if feasible, would necessary be devoid of punitive possibilities; and the prompt and widespread dissemination of notification of a misuse of the designation, essential to effective control, would be cumbersome and expensive. Your Committee presents the considered recommendation that the Executive Board of this Association be directed to investigate the feasibility and legality of copyrighting the "3-A" insignia which appears on the folder appended to this Report, and on the display panel in the booth at the Exposition; and, if copyrighting is practicable, to provide for the institution of a system of licensure for the use of the insignia on equipment and in display material and advertising copy. By such means, and by close collaboration with the National Assoc of Dairy Equipment Manufacturers, those who wilfully employ the insignia, without having obtained a license for its use, would be subject to legal measures; and those who, having obtained a license, nevertheless apply the insignia to non-standard equipment, would be subject to revocation of the license. A resolution pertaining to this matter will be presented at the Business Session.

Respectfully submitted,

C. A. ABELE, *Chairman*
 A. W. FUCHS
 SOL PINCUS
 GEORGE W. PUTNAM
 W. D. TIEDEMAN
 HAROLD WAINESS
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Veterinary Factors in Sanitary Milk Production*

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THE basic consideration in milk production is a healthy cow. Unless milk is produced from such a cow, it cannot be the wholesome, palatable, nutritious food which we all think of as being the basis of the human diet, the source of the protective factors which balance the deficiencies of the cereal diet.

Healthy cows are important, not only because they are capable of producing milk of good quality, but also because they produce an abundance of this milk economically. Such being the case, we believe that the veterinarian is important to the economical production of milk of good quality. The veterinarian is to milk and dairy products what the fireman is to shelter—the source of information regarding the prevention of loss, as well as the possessor of the knowledge and the instruments which hold at a minimum the losses which strike in spite of precautions.

The best use of the veterinarian is secured in this work by having him make regular examinations of the milking cows. The intervals at which these examinations are to be made will vary somewhat with local needs, annual being much more common than semi-annual. Such examination by a veterinarian will often determine the presence of an infectious or detrimental condition before it progresses to a point where human health is endangered or the meat value of the animal is largely or completely lost. In one survey covering 10,500 dairies for a ten-year

period, it was learned that the number of cows condemned was reduced year by year, while the pounds of milk produced daily by each dairy was markedly increased. It was quite evident that the disease-free herd showed a profit far in excess of the cost of the annual examination.

Sanitary milk implies much more than freedom from dirt and harmful bacteria, it implies that the milk has been free from such things at all times. Consequently, the use of pasteurization is not a substitute for healthy cows, healthy milk handlers, and clean utensils. Nor is it a guarantee that the treated product is equal to the milk secreted by healthy cows and handled only by healthy workers using clean utensils. Poor milk, or dirty milk, does not become more palatable as a result of pasteurization, nor by the removal of foreign matter by strainers, filters, or clarifiers. The growth and development of bacteria occurs at the expense of some of the food substances inherent in good milk, and the killing of the bacteria does not restore these materials to their original form or flavor.

Healthy cows must be well fed, especially they must consume an adequate amount of protein. Cows poorly fed produce milk of unbalanced quality. Nature does an excellent job of keeping most of the factors in proper balance so long as reserves are present in the body or are being supplied by the ration, but when a poor ration is fed the body reserves are quickly depleted and it is no longer possible for the cow to obtain all of the materials necessary for the production of milk of high quality.

* Presented at the thirty-third annual meeting of the INTERNATIONAL ASSOCIATION OF MILK SANITARIANS, Atlantic City, N. J., October 24-26, 1946.

Until recent years, the subject assigned would have precluded the need of saying anything about producing milk under clean conditions, with healthy workers; of cooling it promptly and of handling it carefully in clean utensils. It was then agreed that the veterinarian had no duties in this field. But because many of these phases of the work were assigned to officers in the Veterinary Corps, it has been shown that they can be efficiently handled in conjunction with a program which devotes its major effort to promoting animal health. When the veterinary officers returned to civil life, these observations became a part of daily practice, because they had been trained to see them and were in a position to help the client increase the quality and quantity of milk produced by calling attention to the management factors which could be improved readily.

Even so, most of this discussion will be devoted to the diseases of animals transmissible to man through milk and dairy products. We can eliminate the factors just referred to, and we need not consider the diseases spread by meat and meat products, those contracted from handling infected animals, and those transmitted by the bites of insects and rodents.

Diseases may be transferred by milk in several ways. They may be primary diseases of cattle present in the milk when it is secreted. They may be diseases of man which have been transmitted to cows by the milkers or caretakers, and spread only because the cows act as efficient incubators. They may be diseases of man which contaminate the milk, butter, or cheese through carelessness of the handler. They may be spread by food spoilage, contamination of the dairy product before or during its incorporation with other ingredients. For purposes of brevity and clarity the latter two can be eliminated, since the cow has no part in the chain of events leading up to an outbreak of human illness from those causes. We will concentrate on

those in which the cow is active either as the source of the infective agent or as the incubator for a human pathogen.

Four diseases are of prime importance: tuberculosis, brucellosis, streptococcal sore throat, and staphylococcal enterotoxemia. The agents of these and other less common conditions may gain entrance to the udder from the blood stream or through the teat canal, but in either event they will be present in the milk when it is drawn from the udder.

TUBERCULOSIS

Tuberculosis was first to receive widespread attention. Every medical graduate of thirty years ago was deeply concerned about bovine tuberculosis because he was engaged almost daily in removing from the necks of children glands which were enlarged because they were infected with *Mycobacterium tuberculosis*, bovine. In 1917, the veterinarians of America began a program of testing cows for tuberculosis and removing those reacting to the test. Within ten years, the program had advanced to a point where few children had these infected glands, and the medical graduate of that period was seldom called upon to perform the operation. During the past ten years, very few medical graduates have even seen a case of this type, because bovine tuberculosis had been reduced to less than 0.5 percent in every county in the United States. The veterinarian is still in this field by virtue of his periodic retests of all members of the several herds.

A more conspicuous manifestation of human infection with bovine tuberculosis was the hunchback. This condition was caused by tuberculosis of the bone, which is so much more common than pulmonary tuberculosis of bovine origin that for many years it was believed that the latter condition never occurred. One of the very common observations of European physicians and veterinarians who visit the United States is the conspicuous absence of the hunchback, especially in young people.

As a result of the program of testing cows for tuberculosis, it is most unusual now for a bovine case to progress to a point where the lymph glands of the udder have been so greatly enlarged that they burst and discharge the bacteria in the milk. We cannot afford to become complacent about the situation, however, because there have been significant increases in the numbers of tuberculous cattle during the war years. Unless the losses are checked, this disease can again become a serious factor in human health. Although all counties in America have held this infection to less than 0.5 percent of all cattle, there are some in which the disease is noticeably more prevalent than it was three years earlier. And an interesting variation of the problem is the occasional report of tuberculous caretakers having infected entire herds of cattle.

BRUCELLOSIS

Brucellosis has been the subject of much investigational and observational work during recent years. It presents a much more serious veterinary problem than a sanitary milk problem, but a number of questions remain unanswered in both fields. When we think of human brucellosis we must always think of it as animal infection, since the disease spreads from one human being to another only in rare instances if at all.

There are three types of *Brucella* which may cause undulant fever in human beings, and the proper differentiation is important from a veterinary point of view because control of the animal infection depends upon the nature and the source. It is the job of the veterinarian to recognize the type of infection present by the use of periodic tests and physical examinations, and to outline the most successful way of ridding the herd of disease. This is important in a sanitary milk program, if we are to avoid having an undue share of blame laid to the milk.

Brucellosis was first recognized as Malta fever, a disease of British sol-

diers assigned to duty on the Island of Malta. The causative agent was found in milk produced by goats in this Mediterranean island, and in cheese made from such milk. Later brucellosis was recognized as undulant fever in parts of the world where goats and goat milk were unknown. It was then learned that *Brucella melitensis*, the goat strain, is not the only member of the group which is capable of causing human illness, but that *Brucella suis* and *Brucella abortus* are also important.

The natural assumption was that milk was the chief source of human infection with these latter organisms also, until careful studies were made. It then appeared that *Br. abortus* did not transfer readily from cows to human beings through dairy products but that such transfer was accomplished by direct contact with infected cows. It has also been learned that *Br. suis* does transfer readily from pigs to cows and then to man through milk. It also spreads from infected animals to human beings by direct contact.

Where careful studies have been made, it has repeatedly been reported that brucellosis assumes epidemic proportions only when the porcine or the caprine organism are involved. The bovine strain may produce an occasional case of undulant fever, but not a large number of cases in one community. Direct contact with diseased cows is much more dangerous than the use of milk, butter, or cheese from cows harboring *Br. abortus*.

Br. suis spreads readily from the infected sow to the person handling her at farrowing time. It also spreads readily from the infected sow to the cow, if both animals use the same barnyard and pasture, and once it gains a foothold in the cow it will localize in the udder. Here the organisms will multiply rapidly, and they will produce undulant fever in persons who drink raw milk from the cow.

Br. melitensis does not spread to cows as readily as does *Br. suis*, but once established it may spread to

human beings in raw milk, or in butter and cheese made from such milk.

The incidence of brucellosis in persons of different ages offers an interesting opportunity for speculation. Brucellosis is not typically a disease of children, and since children are the heavy drinkers of milk it would be logical to conclude that milk is not the common source of the infection in human beings. There are other factors to be considered, however. We know that calves are relatively resistant to *Brucella* infections, and if we assume that children are similarly resistant it would appear that natural resistance could be responsible for holding down the number of cases of brucellosis among children.

Figures tabulated from several sources are not in agreement regarding the type of *Brucella* organism most commonly encountered in human brucellosis. From some it would appear that the porcine strain is most important, from others that the bovine strain is. In most surveys it was assumed that if the ailing person had been drinking raw milk from a herd in which the blood agglutination test revealed the presence of reactors, then the milk was the source of infection. Such deduction is open to question, and great losses can be caused by loose statements by persons from whom accuracy should be expected and may be taken for granted. These losses may be of a financial nature from failure of the dairyman to dispose of his product or of a more lasting nature because the potential consumer did not enjoy the best of health possible by drinking more milk. A careful typing of *Brucella* is necessary before proper control measures can be instituted.

Brucellosis is fairly common among veterinarians who handle infected cows, sows, and goats at time of parturition. It is also common in packing house workers, especially those who divide the hog carcasses into halves and quarters. Among city dwellers, at least one investigator has reported more cases

among persons recently returned from a tour, a visit, or a hunting trip; and that cases are more numerous among persons who used pasteurized milk at home. Whether use of raw milk containing *Brucella* was the only type of contact has not been clearly recorded in most instances.

However, all of our suppositions and assumptions bring us back to one point, human brucellosis is of animal origin. Therefore the logical method of eliminating this trouble is to remove the animals carrying the infection. The veterinarian has been trained to accomplish this at the most rapid rate possible under the restrictions presented by any particular herd. This process would be accomplished much more promptly if there were a reasonable degree of agreement among the several persons reporting, or if the information presented were of such accuracy and detail as to enable any interested person to draw reasonably accurate conclusions.

STREPTOCOCCI INFECTIONS

Streptococcal infections may be of considerable variety. Some are primarily bovine pathogens, while others are human bacteria which have been transferred to the udder of the cow for incubation and multiplication before being transferred back to human beings.

It is natural to think of mastitis when thinking of streptococci in connection with a sanitary milk program. However, the most common cause of bovine mastitis is *Streptococcus agalactiae*, which is only slightly pathogenic for man. This type of mastitis is a detriment to the production of milk of high quality chiefly because it is accompanied by inflammation. Two factors detract from the quality of milk in mastitis: the large number of streptococci present, and the large number of leucocytes or pus cells drawn to the site by the inflammation. While not directly pathogenic or disease-producing in man, these elements do affect the wholesomeness of the milk and they do

reduce the general excellence of this food.

A periodic udder examination is one way of avoiding the disturbances incident to intermittent high bacteria counts in an otherwise satisfactory milk supply. Milk examinations have been used, and with a marked degree of success. They have failed, however, in some instances because the bacteria counts are high only or chiefly at the time of acute flareup; counts made between such attacks would not be indicative of trouble. Physical examination of the udder, on the contrary, would reveal not only the inflammation which accompanies the acute attack but also the induration or scar tissue formation which indicates that the quarter has been through one or more such flare-ups. Where they have been given a fair trial they have awakened in the herd owner an interest in udder health because they have demonstrated that careful examinations at reasonable intervals mean more milk of a quality which commands a premium payment.

There is a type of mastitis in dairy cattle which is a serious disease factor, namely that caused by *Streptococcus epidemicus*. This is a human organism which can be transplanted to the udder of the cow. This occurs when the milker is a carrier, gets it on his hands before milking, and transfers it to the tip of the teat where the small amount of milk present affords an opportunity for it to migrate up the teat canal into the quarter. Once established in the quarter, *Str. epidemicus* multiplies rapidly, causes inflammation, and seeds great numbers of organisms in the milk produced by the infected quarter. Multiplication of the bacteria is so rapid that the milk from a single infected quarter may contaminate the entire output of a good sized herd and then be pooled with milk from a dozen other herds and still contain enough bacteria to cause an epidemic of sore throat among the persons who drink this milk raw or improperly heat treated.

The streptococcus of scarlet fever works in almost exactly the same way, and may prove just as troublesome as the sore throat organism. It is a human pathogen also, and is transplanted to the udder of the cow by a milker suffering from scarlet fever or passively carrying the organism.

STAPHYLOCOCCI INFECTION

The fourth great group of milk borne human pathogens is the pair of *Staphylococci albus* (white) and *aureus* (yellow). Neither of these is typically an infection of the bovine udder, but both can be transferred from a human carrier and then incubated to such an extent that they may cause epidemics of human illness. To an even greater extent, however, these germs multiply in certain dairy dishes after they have been prepared—and particularly so if such contaminated dishes are permitted to stand unrefrigerated for twelve hours or longer.

DISEASE OUTBREAKS

This by no means exhausts the bacteria which may be transferred from animals to man or from man to man in milk, but it does cover the more prevalent ones. There are such bovine diseases as foot and mouth disease, cowpox, anthrax, erysipelas, rabies, actinomycosis, and milk sickness, all of which are capable of spreading to man but seldom do so in epidemic proportions, and usually cause only isolated cases. There are some diseases which may be spread to man by cows that are only passive carriers; notably diphtheria, botulism, tetanus, and gas gangrene. And there are many human diseases which may be spread in milk through no fault of the cow. Every one of the organisms already discussed is just as dangerous if introduced into the milk after it had been drawn from the cow as it would be if present at milking time, and there is a further group, headed by typhoid fever and paratyphoid fever, which is even

more important than most of those mentioned.

To what extent these latter ones may be considered veterinary factors is debatable, and the reasons for so classing them need not be discussed at this time. Let me rather focus your attention on the numbers of cases of undulant fever in which it was learned or suspected that milk was the source of infection.

During 1944, the last year for which full records are available, there were three outbreaks reported; one involving 10 persons, another 6, and the last 4 persons. In the first community there is no record that an attempt was made to establish the type of *Brucella* present. In the other two, *Br. abortus* was isolated from the milk supply in one instance and from the cream supply in the other.

In 1943 there were four such outbreaks involving a total of 22 human patients, and in no instance was it reported that the type of organism had been identified.

In 1942 there were five such outbreaks, and 42 human beings suffered from undulant fever apparently as a result of milk borne infection. Of this number one community had 25 cases, but the only evidence regarding the source of infection or the type of bacteria present is a statement that the milk was not properly pasteurized. One community had 7 cases, and *Br. suis* was isolated. Another had 4 cases, and *Br. abortus* was found.

In 1941 three communities reported epidemics of undulant fever, one having 77 cases and demonstrating *Br. suis* in sweet cream and milk sold raw. Neither of the other communities had apparently determined the type of *Brucella* present.

The factor which stands out in the mind of a veterinarian looking over this set of figures is this: since the infection undoubtedly comes to human beings from animals, and since the logical way to stop this transfer from animals to man is by eliminating the infected animals which are acting as spreaders, the

basic step to take would be to determine the type of organism present in order that a program for the control of the disease among animals may be formulated. We know that in most herds where *Br. suis* is isolated there is a history of the cows and the pigs using the same barnyard if not the same stalls in the barn. Therefore, in any community having an epidemic of undulant fever involving the porcine strain, it would be advisable to advocate separation of pigs from cows because there would be immediate, widespread, and lasting compliance with such advice. Human nature being what it is, we learn best those lessons which hurt us most. This same advice should be used in other communities, and had been voiced repeatedly by veterinarians, but compliance is spotty except in communities where a direct connection has been established and has been publicized.

In conclusion, may I make one request of your organization and of the individuals who make up this audience? When next you encounter an outbreak of human illness which has apparently been caused by milk or any other dairy product (yes, any food of animal origin), will you call your veterinarian into the discussion of the problem? You will find that he has been well grounded in all of the conditions which may be carried from animals to man, whether they be of human or of animal origin. You will find, also, that he has a wide acquaintance with the people of your community and the livestock which serves as the backbone of all American communities by supplying the most important items of the human diet. This wide acquaintance, and knowledge of the cows in a questionable herd, will often furnish you with information not readily obtainable from other sources, and will then enable you to insure for your community milk and dairy products of high quality, and such as present no hazard to human health because they inadvertently carry elements which can cause human disease.

Technical Advances Made in the Development of New Methods and New Types of Dairy Products*

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PRONOUNCED acceleration in the development of numerous foods took place during the war period. There was urgent need for foods that would possess the military characteristics and would be acceptable by the troops in different parts of the world under varying climatic conditions. The object was to supply the army with foods that would possess the qualities of palatability, eye appeal (color, etc.), and high nutritional value after the period from 6 to 12 months which elapses before the food is consumed in the field.

Among the dairy products that have been technologically advanced and manufactured in large quantities during the war period can especially be mentioned: dry whole milk, dry ice cream mix, bread spread, and butter oil. Although perfection in the manufacture of these foods has not been reached, the products have, in general, been quite acceptable to the Quartermaster Corps.

Dry whole milk to meet the army specifications must have a fat content not less than 26 percent and a moisture content not above 2.25 percent. The acidity, copper, iron, bacteria, and sediment content must be quite low.

In a western plant which has manufactured several million pounds of dry whole milk for military and lend-lease purposes, condensed milk containing 40-41 percent total solids is sprayed at 140° F. through a #69 or #72 nozzle into a chamber. The largest size, all stainless steel drier used at this plant has a drying capacity of 600

pounds finished product per hour. The packing procedure includes (1) "sweeping out" of oxygen between powder particles by carbon dioxide, (2) vacuum treatment of each container, and (3) addition of nitrogen gas to each can immediately before sealing.

Electricity from the Bonneville power plant on the Columbia River is used for the heating of the air used in drying on one of the driers in an Oregon dry milk plant. It is claimed that this electric heating unit is the first of its kind in the United States. The equipment will make an annual power demand of approximately 2,000,000 K.W.H. With this equipment the outgoing hot air is used partly to heat the ingoing air, thus effecting a saving of over one-third of the heat units required.

Dry ice cream mix is another product that has been made in increasing amounts during the war period. The Quartermaster Corps Tentative Specifications (January 1945) require that the product contain not less than 27 percent total fat, not less than 9.75 percent protein, and not over 2.25 percent moisture. For reconstitution $4\frac{1}{4}$ pounds of the powder is mixed with 7 pints water.

Methods of manufacturing dry ice cream mix will vary in accordance with the conditions in the various plants and the raw materials available. Dr. P. H. Tracy of the Illinois Agricultural Experiment Station has outlined the following procedure (In *Ice Cream Trade Journal*, 41, no. 9, 1945):

1. Combine the milk solids, stabilizer and one-fourth the sugar to be used together

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in such proportions as to obtain the desired ratio of solids to one another. For example, if you desired to make an ice cream powder which when reconstituted tested 12 percent fat, 10.8 percent serum solids, 15 percent sugar and 0.24 percent stabilizer, you would combine cream, whole milk, sugar and stabilizer together in such proportions that for every one pound of fat there would be 0.9 pound of serum solids, 1.25 pounds of sugar, and 0.02 pound of stabilizer.

2. Preheat to 170° F. for 20 minutes.
3. Condense as far as the stabilizer used will permit (32-36 percent).
4. Cool and store until sufficient volume is available for drying.
5. Preheat to 150° F. In some plants it may be desirable to add the sugar and stabilizer at this point rather than before condensing.
6. Spray a rather coarse particle if this can be done without too great a sacrifice to plant capacity.
7. Mix remainder of sugar with dried mix in proper proportion to obtain the desired sugar-fat ratio. In this case this ratio would be 15:12. At the same time the powdered vanilla should be added.
8. Package and gas in usual manner.

The mix should be made of milk products of high quality. Steps should be taken to reduce copper and iron contamination to a minimum. Government standards such as for sediment, solubility, solids, and bacteria must of course be complied with.

Army spread for bread is a product prepared from butter, cheese curd, and nonfat dry milk solids. It may also contain: not over 0.17 percent vegetable gum, not over 2 percent emulsifying agent, not over 0.1 percent benzoate of soda, not over 0.1 percent antioxidant, and approximately 2 percent salt. In addition not less than 8,500 U.S.P. units of vitamin A shall be added per pound of finished product (Q.M. Corps Tent. Spec., July 1943).

In manufacturing army spread, the ingredients shall be thoroughly mixed and comminuted while heating into a homogeneous mass. The mixture shall be heated to a temperature of not less than 160° F., nor more than 180° F. The containers shall be filled with the

product at a temperature not lower than 145° F. and shall be held at a temperature not lower than 142° F. for not less than 20 minutes, the latter holding time to be included in the cooling process.

The finished product shall not oil off when held for 24 hours at 120° F. It shall have a butterfat content of not less than 56 percent, and a moisture content of not more than 29.5 percent.

Carter's Spread, in accordance with the army specifications, shall be prepared from butter, hydrogenated cottonseed oil, and, in addition, 0.1 percent benzoate of soda, not more than 0.5 percent emulsifying agent, not more than 0.1 percent antioxidant, and approximately 4 percent salt. In addition, not less than 7,500 U.S.P. units of Vitamin A shall be added per pound finished product. The spread must contain not less than 68 percent butterfat.

In manufacturing this product, the butter and vegetable oil shall be melted together, and the other ingredients added to the mixture, the whole being thoroughly mixed into a homogeneous mass. The mixture shall be heated to a temperature of not less than 150° F. nor more than 180° F. and held at a temperature within that range for not less than 10 minutes. The mixture shall then be cooled as rapidly as possible under agitation or any other mechanical means which produce a satisfactory emulsion. The containers shall be filled with the product at a temperature not to exceed 90° F.

The finished product shall have a melting point (Wiley) of not less than 118° F. It shall not oil off when held for 24 hours at a temperature of 110° F. The total fat content shall be not less than 80 percent.

Dairy spreads utilizing cream, milk, dry milk, condensed milk, cultured milk with added color, vitamins and flavor have been developed during the past two or three years.

One product known as "Dyne" was

developed in 1943 by the University of Wisconsin Department of Dairy Industry. Dyne is the collected trademark of the Wisconsin Alumni Research Foundation. Dr. K. G. Weckel, in a private communication, reported that "Dyne" is prepared as follows: "28 percent fat, 19-20 percent solids not fat, using either a condensed product (a mix condensed in the pan) or by mixing whole or skim powder and cream. To the mixture is added 20 percent by weight of cultured buttermilk, 1.3 percent salt and lactic acid (25 grams per 25 pounds total mixture). The product is then pasteurized at 145° for 30 minutes. When the holding period is over, starter distillate is added and the product homogenized at the pressure necessary to impart a slight but definite thickening. It is filled immediately (hot) into containers, which are then cooled by storage in the refrigerator. Upon cooling the products develops a body or 'set.'" The label on the container gives the following composition of the product: "Cream, milk, cultured buttermilk, lactic acid, flavor derived from cultured buttermilk, salt, Vitamin A and Vitamin D. Moisture 56 percent, butterfat 26 percent, milk solids not fat 16 percent, salt 1 percent, Vitamin A—9,000 U.S.P. units per pound, derived from fish liver oils, Vitamin D—3,200 U.S.P. units per pound, derived from irradiated ergosterol."

"Dyne" spread has been sold in half pint milk bottles at 23 cents. The product keeps satisfactorily for two to three weeks.

Several types of commercial butter spreads may be made. Four general types are: (1) whipped butter; (2) a combination of whipped butter and other dairy products, a water-in-oil emulsion; (3) a homogenized oil-in-water emulsion made from butter and other dairy products, and (4) a liquid oil-in-water emulsion discharged under nitrous oxide pressure resulting in a whipped butter spread.

Drs. H. Pyenson and P. H. Tracy of the *Illinois Agricultural Experiment Station*, in 15, 1943, nos. 9 to 11, of *Food Industries* give the formulas for "Stabilized, Homogenized Butter Spreads" and "Whipped Butter Spreads."

Examples of the stabilized homogenized spread are:

	(a)	(b)
Salted butter	55.5 lb.	43.0 lb.
Cream, 19 percent*..		54.7 lb.
Skim milk	42.2 lb.	
Skim milk powder...	2.0 lb.	2.0 lb.
Gelatin	0.3 lb.	0.3 lb.
Salt	5.0 lb.	5.0 oz.
Butter color	75 ml.	25 ml.
Starter distillate	25 ml.	25 ml.

* The equivalent of heavier cream and skim milk may be used.

DIRECTIONS

Add the gelatin, salt and skim milk powder to the mix at 90° F. Agitate and heat to 150° F. for 30 minutes. Homogenize at 3,500 lb. pressure. Cool, add starter distillate, package and allow to set in the refrigerator until firm.

An alternative formula, using heavy cream, contains:

Cream, 46 percent.....	98 0 lb.
Skim milk powder	1.7 lb.
Gelatin	0.3 lb.
Salt	1.5 lb.
Butter color	150 ml.
Starter distillate	30 ml.

REMARKS

The product obtained by this method is very smooth and can be spread easily as soon as it is removed from the refrigerator. It can be packaged hot, directly from the homogenizer, but better results are obtained when packaged after cooling.

Spreads of this type can be made in plants equipped with either a viscolizer or homogenizer.

The butter color can be omitted. The starter distillate is added to improve the butter flavor and aroma, and should be added to the finished product after cooling. There are various commercial products containing coloring and vitamins that may be added to

improve the appearance and increase the nutritional value of such spreads.

Since the moisture content is much greater than that of butter, there is a tendency for a slight shrinkage to take place on storage, and properly water-proofed containers, such as the paraffined containers used for cottage cheese, are necessary. A slight syneresis may occur if the spread is not kept under refrigeration.

When properly refrigerated, and when made from high quality products, these spreads should keep well for two or three weeks.

Examples of the whipped butter and butter spread are:

	<i>Whipped Butter</i>	<i>Whipped Butter Spread</i>
Salted butter	100 lb.	50 lb.
Cream, 19 percent *		50 lb.
Butter color	50 ml.	90 ml.
Starter distillate		25 ml.
Salt	8 oz.	6 oz.

* Or the equivalent in cream and skim milk

DIRECTIONS

For the whipped butter, soften to about 65-75° F., so that it is soft enough to work easily. Add the salt and butter color. Whip until the desired overrun (50 to 100 percent) is obtained, then run directly into packages and place in the refrigerator at 40° F. to harden.

The butter spread is made by whipping the butter in the same way. Add the starter distillate and salt to the cream, then slowly add this to the whipped butter, and continue whipping until the desired overrun is obtained. The greater the overrun in the whipped butter, the greater will be the overrun in the finished product. The finished spread should test about 50 percent butterfat and 4 percent milk solids-not-fat.

In an unpublished paper, Pyenson and Tracy state the following regarding the food value of butter spreads: "Since these spreads contain only 45 percent to 50 percent of butterfat, their caloric value is less than that of butter. Butter and whipped butter

contain approximately 3,470 calories per pound or 108 calories per serving of ½ ounce; type 2 spread contains 2,191 calories per pound or 69 calories per serving of ½ ounce; and type three and four spreads contain approximately 2,019 calories per pound or 63 calories per serving of ½ ounce. Butter normally contains 0.7 percent milk solids-not-fat whereas these spreads contain up to 6 percent of milk solids-not-fat depending on the type of spread. Spreads made as directed are rich in pure milk fat, which is the most digestible of all fats and the best source of body energy obtainable. Butterfat is the only food fat which contains certain natural elements that are essential for growth and health. These butter spreads besides containing the vitamins A and D contain a liberal amount of the water soluble vitamins such as riboflavin."

Note: These spreads, if sold, may violate the present Federal Food, Drug and Cosmetic Act and perhaps certain state laws.

Butter oil or milk oil is the almost moisture-free milk fat obtained in various ways from cream or from butter. Because of its high food value, it lends itself admirably to overseas shipment. It is also valuable as a product to be stored for use during periods of scarcity of butterfat. A bibliography on butter oil can be obtained from the United States Department of Agriculture, Washington, D. C.

The Quartermaster Corps has no specifications for butter oil but the requirements for the product would be: 0.0 peroxide value, not more than 0.2 percent free fatty acid, and not more than 0.05 percent moisture as determined by the Fischer Titration Method (Special communication by Lt. R. J. Remaley, Chief, Dairy Products Branch, Q.M.C. Subsistence Research and Development Laboratory).

A. *New Zealand method* (The Commercial Production of Dry Butterfat. *New*

Zealand Jour. Sci. Tech., Vol. XXIV, no. 2B, 1942).

This method was developed in New Zealand during the war. The object was to prepare pure dry butterfat on a large scale with equipment obtainable within the country.

Procedure

1. Extrude the butter from a bulk-butter packer into a closed melter-cylinder.
2. Melt the butter, using 1 pound per sq.in. steam pressure.
3. Pump the melted butter to separating cylinders. Gravity separation of serum takes place.
4. Pass fatty portion through a cream separator, and then through a pasteurizer to two other separators.
5. The nearly dry fat is run down the steam-jacketed walls of a vacuum pan for drying at a vacuum of 29 inches.
6. Pump the dry fat through a rotary cooler to the filling line.
7. The serum from the separating cylinder and from the first and second series separators is re-separated twice. The recovered fat is then treated as above.
8. The fat loss amounts to from 0.9 to 1.3 percent of the fat in the butter.
9. The butterfat produced is free from toffee flavor.
10. The dry fat has a moisture content of from 0.02 to 0.04 percent.
11. There is no loss of Vitamin A during processing.
12. The oil is placed in tinned containers and is then stored at 45° F.

B. American method

The following is a general outline of the procedure for preparing butter oil by one of the methods developed in the United States.

1. Melt the butter.
2. Dilute the melted butter with warm water.
3. Neutralize the free fatty acids.
4. Separate the oil and the serum, using a specially designed separator.
5. Continuously subject the oil to high temperature vacuum steam treatment, steam distillation, and vacuum cooling. This is effective in removing the last traces of moisture resulting in dry oil free from curd.

In a patented process, where cream is used at the beginning, one additional

centrifugal separation is employed in the continuous operation to prepare butter oil.

Dehydrated Cheese. A new method of dehydrating cheese has been developed by Dr. G. P. Sanders of the U.S.D.A. Bureau of Dairy Industry. By removal of the water from Cheddar cheese, the weight can be reduced about one-third. As dehydrated cheese may be compressed into rectangular blocks the space conserved, as compared with the original cylindrical form, is from 40 to 46 percent. This was a definite advantage in saving shipping and storage space during the war.

The method developed is as follows:

1. Under an air current cut the edible portion of the cheese into rectangular bars and grate it by means of a mechanical grater into small, thin flakes.
2. Allow flakes to fall onto trays in a uniform layer containing about 0.35 to 0.5 pound of cheese per square foot.
3. A preliminary drying consists of forcing air at a temperature of from 72° to 82° F. and a relative humidity of from 25 to 35 percent or lower between the cheese particles. The moisture content during 30 to 90 minutes is reduced to about 10 percent.
4. Final drying is accomplished by placing the trays on shelves in a tunnel and passing air at a temperature of about 145° F. through the layers of cheese particles. This reduces the moisture content to less than 3 percent in 1½ to 2 hours.
5. After drying, the particles of cheese are cooled in order to solidify the fat.

The two stages of drying could be combined in a continuous process.

Uses. Dehydrated cheese may be used in cooking as for macaroni and cheese. It may also be used with salads, desserts, and in spreads.

Further information on this product may be obtained from the Bureau of Dairy Industry.

Sterilized cream has been made in a California plant for several years. The bottled product can be kept at ordinary temperature for many months without deterioration.

Before processing 0.25 per cent stabilizer is added. The purpose is to

prevent separation during storage. The cream is sterilized at a temperature of from 260° to 280° F. The bottles and caps are steam sterilized under pressure before they are used. The air in the bottling room is cleaned by an electric dust precipitator before it enters the room. Ultraviolet lamps are used in the room as a means of destroying airborne microorganisms. The operators in the bottling room must wear sterilized uniforms, gloves and face masks. Random selected samples from each batch undergo a thorough laboratory examination extending over a period of several days.

Milk pudding is a new development by the U.S.D.A. Western Regional Laboratory, Albany, California. The pudding can be prepared in a few minutes and no heating is required.

Formula

A. Low-methoxyl pectin	4 grams
Sugar	4 grams
B. Sugar	40 grams
Powdered milk	50 grams
Salt	1 gram
Flavor—chocolate, vanilla, butterscotch, or other non-acid flavor materials	

Directions

To "A" add 2 cups of cold water and stir until the pectin is dissolved (requires 1 to 2 minutes). Add "B" and stir until milk has been completely dispersed, resulting in a smooth texture. Pour into moulds and allow to stand for 5 minutes or longer. Chill if desired.

Canned chocolate-malt flavored milk is now being marketed. One of these products is packed in accordance with a new, patented method. It is a "full cream milk" with sugar, cocoa, malt extract, algae stabilizer, salt, and artificial flavor. The milk, when kept in the hermetically sealed can, will keep well without refrigeration.

Casein fiber, popularly known as casein wool, is now being commercially made in several countries. Its use in the textile industry is still in the development stage. It is uncertain whether casein wool will ever find the same acceptance as rayon. Doctor

Whittier of the Bureau of Dairy Industry has pointed out that the annual supply of skim milk, over and above that used for food and manufactured products, is 40 billion pounds. This, he stated, is equivalent to 1 billion pounds of casein. As 1 pound of fiber can be made from 1 pound of casein, 1 billion pounds casein fiber could be produced. This is equal to about one-half the annual world production of rayon and is more than twice the yearly consumption of wool in the United States.

U. S. Patent 2,140,274 by Whittier and Gould of the Bureau of Dairy Industry is for "a fiber comprising casein, salts of casein, and fat acids and for a fiber in which the aluminum salt of casein is specifically claimed as a component. Any acid-precipitated casein of reasonably good quality may be used in this process, compounds of aluminum or other amphoteric element being added to the alkaline casein solution to increase tensile strength and water-resistance of the fiber. Fat acids are added to overcome the tendency to brittleness or, in other words, to make the fibers flexible. The solution is extruded, with no preliminary aging, through a spinneret into an acid bath containing formaldehyde and substances, such as salts or sugars, to increase the osmotic pressure in the bath and thereby hasten the "setting-up" of the fiber. The fiber is then stretched and wound." A discussion of the advantages and commercial possibilities of casein fiber is outside the scope of the present discussion.

Cheese whey is a potential source of a number of products. In 1944 a total of 141 million pounds of dry whey was manufactured. The product contains lactose, albumin, minerals, and vitamins. The chief use of dry whey is in the preparation of poultry feed. The constituents of whey also find use in the manufacture of human foods, plastics, and pharmaceutical products.

The Bureau of Dairy Industry,

U.S.D.A. has been active in conducting research on whey utilization. The chief of the Bureau, Mr. O. E. Reed, has reported on the following:

1. Separation of the whey constituents by a new method based on removal of the lactose from concentrated whey by alcohol.
2. Production of a syrup containing a mixture of dextrose, galactose, and lactose.
3. Utilization of whey solids in the manufacture of taffy, fudge, and caramels. A new type of candy, containing 40 percent whey solids was devised.
4. Incorporation of whey solids in dehydrated pea soup.
5. Preparation of a canned pudding, utilizing whey solids in place of eggs.
6. New products, such as plastics from the lactose in the whey. One of these is polymethylacrylate, which is reported to have the optical properties of the commercial methylacrylate plastics and possessing a high degree of elasticity and solubility which permits its use in impregnating fabrics, in insulation, and numerous other industrial applications.

Another important use of lactose from whey is in the manufacture of the wonder drug penicillin. In 1944 a total of 5 million pounds lactose were used for this purpose.

Of 7½ million pounds lactose manufactured in 1942 about 3 million pounds were used in baby foods, about 2½ million pounds for pharmaceuticals and 2 million pounds were used in various food and industrial products.

It has been reported that lactic acid has been used in the manufacture of rubber. The acid is transformed into methylacrylate and this, in turn, to the synthetic rubber—lactoprene.

We can look forward to seeing further expansion in the use of whey solids—through research.

Canned acidophilus milk in pure culture for administering by dairy farmers to new-born calves as a preventive of scours, and similarly by sheepmen for the control of dysentery in new-born lambs, was developed by the dairy department at Oregon State College after Drs. Shaw and Muth of the Veterinary Department had demonstrated the efficacy of the cultured

milk for this purpose. Several hundred gallons of this product, placed in 15 oz. cans are sold annually, on a cost basis, by the dairy department to dairymen and stockmen. Full information regarding the preparation of the product is given in Station Technical Bulletin 5 obtainable free from the *Oregon Agricultural Experiment Station, Corvallis, Oregon.*

Homogenized market milk was first sold commercially in 1935. It is estimated that about 10 to 15 percent of the market milk now sold is homogenized. The industry was confronted with a number of problems incident to the processing, packaging, distribution, laboratory control, cooking, and utilization of returns, of homogenized milk. The extensive work of Trout and associates of the Michigan Agricultural Experiment Station and of other scientists has solved many of the problems. When appearing on the program of the annual Oregon Dairy Manufacturers' "Dairy Week" in 1942, Doctor Trout discussed the problems and outlined methods for overcoming them. The following is taken from his talk:

1. The chief problem in homogenizing milk is that of the development of *rancidity*. The milk must be pasteurized at a temperature sufficiently high to inactivate the enzyme lipase, in order to prevent the development of a rancid, bitter, or soapy flavor. The milk must be pasteurized prior to homogenization or immediately following the process. The homogenized, pasteurized milk must not be contaminated with raw milk.
2. *Sediment* in the bottom of the container is another problem. The sediment consists largely of milk cells, milk solids, colloidal dirt, and some milk fat. It is similar to separator slime. Clarification of the milk by a centrifugal clarifier will overcome sedimentation.
3. Homogenization may cause an *increase in bacterial count* as determined by the plate method. If properly washed and sterilized, the homogenizer is not a factor in increasing the count. The increase is due to the breaking up of clumps and chains of bacteria during homogenization.
4. A *cream plug* may form on the surface of the milk. The milk may be improperly

- homogenized, or non-homogenized milk may have been added. With proper homogenizing a cream plug will not form.
5. *Foaming* may occur during bottling of homogenized milk. Carrying a high head in the cooler trough and bottling supply tank, and eliminating air leaks in the lines will aid in overcoming this difficulty.
 6. To prevent *seepage* around the cap seat, bottles may be filled to within one-quarter inch of the cap seat. Proper refrigeration of the bottled milk at all times is necessary. Freezing of the milk must be prevented.
 7. When *testing* homogenized milk for fat by the Babcock method, follow the correct procedure, but add the acid in three installments and mix thoroughly and longer than usual before centrifuging.
 8. Homogenized milk may sometimes *curdle* when used in cooking. It is apparently more sensitive to heat than is non-homogenized milk. This may be an advantage with some forms of cookery.
 9. As *separation of fat* from homogenized milk is difficult, daily surpluses should be kept to a minimum. Unused homogenized milk may be successfully used for buttermilk, cottage cheese, or ice cream.

Vacreation of cream for butter was studied by the Iowa, Manitoba, and Oregon Experiment Stations. The method, which is a triple-treatment process of (1) quick-time pasteurization, (2) partial distillation and removal of certain volatile products, and (3) cooling, all under a partial vacuum ranging from about 6 inches to 28 inches, was found to have a beneficial effect on butter quality when good cream was used at each of these experiment stations. The method was found to be efficient in destroying bacteria.

Vacreation of milk for cheese and vacreation of ice cream mix was found satisfactory at the Oregon Agricultural Experiment Station in preliminary tests made by Mr. R. P. Robichaux.

Condensing milk with the Vacreator is a new development at the Oregon Agricultural Experiment Station. Although the Vacreator* was designed by Murray and Board for the specific

*"Vacreator" is the registered trademark designating the Murray vacuum pasteurizers.

purpose of pasteurizing and conditioning cream and other milk products, it was found that the Vacreator could be used as an efficient milk condenser. With the "Baby" model Vacreator it was possible to remove 500 pounds water per hour from the milk and with the "Junior" machine 1,000 pounds per hour could be removed. The condensed milk had an excellent flavor. *Oregon Agricultural Experiment Station Bulletin 430*, by G. H. Wilster gives the results of the research and the application of the method to the preparation of ice cream mix. See *Food Industries*, 17, October, 1945, and *Ice Cream Field*, 46, November, 1945.

Frozen concentrated milk appears to have some market possibilities in areas where fluid milk is scarce. It would also be satisfactory to use on ocean going ships. Studies during recent years on the manufacture of frozen concentrated milk indicate that a product which keeps well and reconstitutes satisfactorily can be made. Messrs. Doan and Leeder of the Pennsylvania Agricultural Experiment Station after having conducted research on the problem of freezing milk condensed to one-third its volume suggested (*Food Industries*, 16, 562, 1944) the following manufacturing procedure: Clarify high quality milk, pasteurize at a high temperature, condense, homogenize, freeze in ice cream freezer (preferably continuous), place in packages, finish freezing in a room at -10° F. They stated that "The frozen concentrated milk is defrosted and reconstituted to the fluid state by undisturbed thawing in hot water. This results in a fluid milk having properties which the average consumer would find difficulty in distinguishing from those of fresh fluid milk."

This presentation would not be complete without briefly referring to several other important developments in the field of dairy technology.

Short-time pasteurization of market milk has gained in popularity in recent

years. All-automatic machines, utilizing either hot water or electricity as a heating medium, is a marvelous improvement over the milk pasteurizers that were in use 20 to 30 years ago.

Vacuum treatment of market milk prior to short-time pasteurization was found beneficial by the New York (Cornell) Experiment Station in preventing the development of an oxidized flavor in the milk and also in preserving the Vitamin C content of the milk.

Square Glass Milk Bottles have become popular owing to the smaller space this shape of bottle occupies in a household refrigerator.

Paper milk containers have come into use since 1929. They are rapidly gaining in popularity. In a study by Drs. Prucha and Tracy of the Illinois Agricultural Experiment Station, it was found that after four years of using glass and paper bottles at intervals, 95 percent of the consumers preferred the paper bottle. The investigation showed that paper milk containers are sanitary as well as practical for fluid-milk distribution.

(*Agricultural Experiment Station*, Bulletin 495, University of Illinois, Urbana, Illinois.)

In the cheese industry important developments have been (1) wider use of pasteurization of milk to be used for cheese, (2) curing of cheese in cans, (3) merchandising cheese in transparent wrapping material.

The field of cheese manufacture, including the ripening of cheese, offers an opportunity for unlimited research.

In control work the greatest development in recent years is perhaps the application of the phosphatase test for checking on the efficiency of pasteurization. Recently Sanders and Sager of the U. S. Bureau of Dairy Industry have modified the phosphatase test as used for milk so that it can be used with cheese to determine whether the milk used had been adequately pasteurized. (Bureau of Dairy Industry, U. S. Department of Agriculture, Washington, D. C., *Circular of Information* no. 22, May 1945. See also J. MILK TECHNOL., 9 (1946), May-June, p. 171-2.)

Standard Methods for Dairy Products

Report of Joint Editorial Committee

THE Committee on Standard Methods for Dairy Products wishes to present a 325 page manuscript covering the proposed ninth edition of *Standard Methods for Dairy Products* of the American Public Health Association. This report is the work of four groups: (1) Committee on Milk and Milk Products of the Laboratory Section, (2) Committee on Frozen Desserts and Their Ingredients of the Laboratory and Food and Nutrition Sections; (3) Committee on Assay of Foods of the Food and Nutrition Section; and (4) the Association of Official Agricultural Chemists.

Directions for some of the older technics have been improved and a few

new and promising technics have been introduced. Among the new methods are the resazurin test, the methods that have been developed by the Federal Food and Drug Administration for determining the amount and type of extraneous matter in dairy products other than market milk and cream, and methods for the bacteriological examination of stabilizers used in frozen desserts.

Only two changes in commonly used technics will cause enough change in results secured to be worth mentioning:

(a) The temperature given for the incubation of agar plates in the eighth edition are 32° or 37° C. After consultation with the Directors of State

and Provincial Laboratories and others, the incubation temperatures have now been established at 32° C., or at 35° C. This will increase the accuracy of results especially where the temperature used is 32° C. However, those laboratories that lower the temperatures used for agar plates will secure somewhat higher counts than they have had previously. Administrators should therefore modify enforcement procedures until the industry has been able to adjust itself to the more severe requirements.

(b) The hourly inversion of tubes during incubation of samples for the methylene blue reduction test will cause reduction to take place somewhat quicker in certain samples of milk and there will be a greater accuracy in the results secured.

The Committee is deeply concerned over the findings reported by Black (*Public Health Reports*, 58, 1605, 1641, and 1681, 1943) which showed that many laboratories do not follow essential requirements outlined in Standard Methods for making bacteriological analyses of dairy products. These findings should not be ignored. The records indicate that laboratory work is best done in those areas where state or provincial departments of health supervise the methods used in milk control laboratories in their respective jurisdictions.

Supply houses report that thousands of bacteriological incubators of the type that are heated with high temperature hot plates in the bottom of the chamber have been sold during the past year. From this it may be presumed that little heed is paid to the warning in

the Standard Methods Report since 1939 that incubators of this type are unsatisfactory for milk work.

Some additions have been made to the Chapter on the Determination of Vitamins by the Committee of the Food and Nutrition Section. These consist of methods for the Determination of Vitamin B, B₂ and Niacin.

The most important improvement in the new report has been made by Dr. A. N. Robertson. He has edited the entire text so as to give the reports of the various referees a uniform simple and direct style. A simple cross reference system has also been introduced. Discussions of the applications and limitations of the various technics have been rewritten by Dr. Luther Black and have been segregated in a separate chapter at the beginning of the report.

All of this editing and rearrangement will lead to better indexing that will make the report more usable, thereby fully justifying the printing of a new edition.

R. S. BREED, *Chairman*
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Geneva, New York.
November 10, 1946.

(Action was taken at the Cleveland meeting by all of the Section groups and by the Association Committee on Research and Standard recommending to the Governing Council the publication of this manuscript as the *Ninth Edition of Standard Methods for Dairy Products*.—Editor.)

SAFETY FACTORS OF H. T. S. T. PASTEURIZERS

(Continued from page 26)

PLATE I.



Description of Syringe Shown in Plate I

The cylinder of the syringe is made of an eight inch length of one and one-half inch stainless steel tubing which has a capacity of about 25 ml. per linear inch. A #15RG union (gasket seat) is soldered to each end of the tube. The piston is made of a solid stainless steel rod, turned down so that it fits loosely in the cylinder. An old homogenizer piston may be used for this purpose. If lightness is desired the piston may be drilled out. The sealing of the piston is accomplished by placing a rubber gasket in one of the gasket seats of either union. As the hex nut #13H is tightened a tight joint is formed around the piston. The rubber ring used on some clarifiers is suitable for the purpose. A standard cap is placed at the discharge end of the syringe. This cap is drilled and fitted with a one-half inch piece of stainless steel pipe at least two inches long. If this pipe is less than two inches long difficulty may be encountered in

reaching the injection port of the sampling cock. A round ended rubber stopper is fitted on the one-half inch pipe to serve as a tight joint when injecting.

A standard sampling cock is used as a means through which to introduce the cold solution into the holder. A type which, when installed, is flush with the flow stream in the holder is mandatory. If leakage should occur during injection past the stem of the valve a small rubber band should be mounted on the stem between the valve body and spring and held in place by a washer. If a very light spring is used on the sampling cock it will compress from the force of injection and eliminate the necessity of a second person to open the sampling cock.

(NOTE: "Plant operators who make up their own pipe fittings should have no difficulty in making this syringe.")

JOURNAL OF MILK AND FOOD TECHNOLOGY

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Horatio N. Parker, 1871-1946

Horatio N. Parker, former president of the International Association of Milk Sanitarians (1932), passed away at his home in Jacksonville, Florida, after an illness of several months.

Mr. Parker retired from the position of Director, Division of Pure Foods and Laboratories, Department of Public Health, Jacksonville, Florida, in November 1945. His outstanding contributions to public health were published in the September-October issue (1945) of this JOURNAL, pages 302 to 304.

Born in Cambridge, Massachusetts, February 3, 1871, he studied at the Massachusetts Institute of Technology in 1890-1895, and held positions as bacteriologist, sanitarian, health officer, chemist, writer, and lecturer. He is listed in "Who's Who in America," "American Men of Science," "The Southerner," and "Who's Who and What to See in Florida—1935."

Mr. Parker was held in high esteem by the public and his professional colleagues. We shall miss him. His influence will live on, and the work that he did will continue to pay dividends for a long time. Happy are our memories of him.

Hermann C. Lythgoe Retires



With the retirement of Hermann C. Lythgoe, the food control forces have lost one of the old guard. He retires from the position of Director, Division of Foods and Drugs, Massachusetts Department of Public Health, Boston, after a half century of public service.

Lythgoe received his B.S. degree in chemistry from the Massachusetts Institute of Technology in 1896. After about a year of chemistry in the rubber industry, he was appointed (in November 1897) to the position of assistant analyst of the Massachusetts State Board of Health, and worked for ten years under Albert E. Leach. In 1907 Leach became the chief of the Denver (Colorado) Station of the Bureau of Chemistry, U. S. Department of Agriculture, and Lythgoe was promoted to the vacancy. In 1915 after the reorganization of the State Board of Health into the Department of Health, the first Commissioner of Health of the Commonwealth, Dr. Allan J. McLaughlin, invited Lythgoe to take charge of several groups in the Department and make them into a division which would function smoothly. This he did successfully. In 1897, the food and drug law enforcement personnel consisted of two chemists and three inspectors with a laboratory in the State House. In 1946 it consists of a division director, a chief of laboratory, four assistant and junior chemists, one junior bacteriologist, three laboratory helpers, ten inspectors, two veterinary inspectors, and eight clerks, all working in or from the State House. In addition, there are two laboratories located in the State Tuberculosis Sanatorium at Westfield under the charge of a senior chemist: one devoted to the usual food and drug work and the other

to vitamin bioassays, the personnel of both consisting of the director (a senior chemist), two junior chemists, one junior bacteriologist, two laboratory helpers, two inspectors, and one clerk.

Lythgoe belonged to that early group of trail blazers who made food control and analysis what it is today—Leach, Winton, Bigelow, Osborne, Hortvet, *et al.* The chemist in a health department is (and was) called upon to do many things other than food analysis. "The toughest job I ever had to do was the manufacture of 606 later known as arsphenamine. Dr. McLaughlin secured an appropriation for that purpose, and I spent five thousand dollars of the state's money to find out the 'know how.' Several persons familiar with the difficulties told me that the Commonwealth got out of that part of the work very cheaply. We made arsphenamine and later sulfarsphenamine for distribution to the State institutions and to the clinics under departmental supervision for a period of about ten years or until the price due to very large scale production was such that it was cheaper for the State to buy it." When he met Dr. McLaughlin later at the 1943 meeting of the American Public Health Association, in a discussion of the arsphenamine work, the Doctor remarked, "Hermann, how did we ever put it over?" Lythgoe replied, "Allan, we were young. Today I would not have the courage to tackle a job of that nature involving modern industrial synthetic organic chemistry."

He tells of the Irishman, at one of his food cases, who said, "We must get at the truth of the veracity." There is a need, many times, for just this distinction.

The food manufacturer who intends to violate the food laws is usually at least two years ahead of the food inspection chemist. Lythgoe had to study

(Continued on next page)

Correspondence

Journal of Milk Technology
374 Broadway
Albany, N. Y.

Gentlemen:

Referring to an article on "A New Germicide for the Food Industries," by W. E. Bobwright, Vestal Laboratories, St. Louis, which appeared in the March-April issue of the JOURNAL, pages 101 to 106 inclusive:

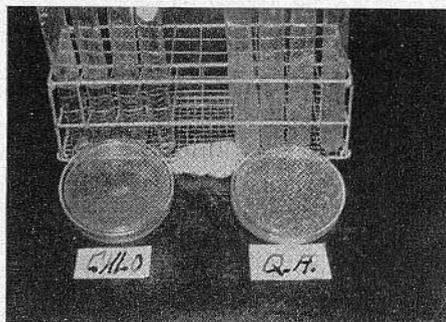
We wish to call your attention to some of our own laboratory work in quarternary ammonium germicides in the milk industry which is at variance with statements on page 105. In two instances experimental checks set up according to directions of the manufacturers show that they were not effective on gram negative organisms when in contact with milk.

At least one other source agrees with our own experiences, and indicates such compounds are only efficient for sterilizing equipment which has been washed free of milk. If milk is present in any appreciable amount, the power of the disinfectant weakens, like that of chlorine in that it reacts chemically with milk proteins and does not disinfect.

In spite of enthusiastic reports upon the value of these products, which in general seem to be justified, we urge caution in the milk industry as gram negative organisms might build up toxic poisons which are dangerous to public health.

We reported the result of our tests to the U. S. Public Health Service under date of August 8, 1946. Enclosed you will find photograph taken at the time of our latest laboratory check on one of those tested. Further work is suggested where gram negative organisms may be present in any equipment used in the preparation of foods.

Very truly yours,
(Signed) C. H. BUGBEE, *Supervisor*,
CHB:C City Health Department



Hermann C. Lythgoe Retires

(Continued from preceding page)

each violation before he was warranted to prosecute. As a result his organization published many papers. During the past ten years they sent twenty articles to scientific journals, six to trade journals, and two in *The Nucleus* (a bulletin of the Northeastern Section

of the American Chemical Society). He commends his excellent staff and states that the division has functioned "like a frictionless bearing."

Although officially retired, Dr. Lythgoe is active. We shall hear from him from time to time as he draws on his wealth of experience in food control work.

1946 DAIRY TECHNOLOGY CONFERENCE, UNIVERSITY OF MARYLAND

**Dairy Technology Conference University of Maryland**

The second annual Dairy Technology Conference at the University of Maryland was held December 3, 4 and 5. One hundred and eighty-six persons registered for the conference representing more than 50 different dairy organizations. The rather broad program arranged consisted of topics of interest to those in market milk, ice cream, dairy inspection and dairy field work. The visiting speakers included Dr. C. D. Dahle, Penn State College; Dr. C. S. Bryan, Michigan State College; Dr. H. A. Trebler and Dr. R. P. Myers, Sealtest Laboratories;

F. A. Korff, Baltimore City Health Department; O. M. Johnson, International Association Ice Cream Manufacturers; R. A. Simonet, Robert A. Johnston Co.; W. S. Cavanaugh, York Corporation; Dr. E. R. Price, U. S. Public Health Service; Frank Bushek, Atlantic Dairy Association; Dr. V. C. Moyer, Supplee-Wills-Jones Corporation; Dr. H. L. Ragsdale, Abbotts Dairies; Dr. C. W. England, C. Y. Stephens Dairy Industries; C. S. Brinsfield, Maryland Health Department; Dr. P. C. Brown, Maryland Sanitary Livestock Service; J. B. Shepard, U. S. Department of Agriculture.

Cherry-Burrell's New Booklet

The Cherry-Burrell Corporation has recently issued a bulletin on washing powders. In addition to listing the many different kinds of its line of washing compounds, this bulletin contains suggested cleaning procedures for milk, butter, cheese and ice cream plant equipment. There are special articles on milkstone control churn care and conditioning, cleaning plant floors and walls, and de-scaling bottle washers. Copies may be obtained by writing any Cherry-Burrell Branch.

Oregon Dairy Manufacturers' Association

The 36th Annual Convention of the Oregon Dairy Manufacturers' Association will be held at Oregon State College Corvallis, Oregon, February 18, 19, and 20. The program for the meeting will be available at a later date. The plan calls for the appearance on the program of nationally-known authorities on dairy subjects. The usual dairy products contest will be held. The men's dinner and smoker will be during the evening of the first day and the annual banquet will be during the evening of the second day.

G. H. WILSTER
Secretary

New Members

ACTIVE

- Anderson, W. S., Director, Bureau of Milk Sanitation, State Department of Health, Harrisburg, Pa.
- Andrews, John, Sanitary Engineer (R), U. S. Public Health Service, Washington 25, D. C.
- Chaffee, Curtis W., Inspector, Dairy & Food Commission, State of Connecticut, 58 Earle St., Hartford, Conn.
- Cox, Thomas, Dairy Inspector, Department of Public Health, 191 Park St., Hamilton, Ontario, Canada
- Dodson, Lewis, Director of Public Health Practices, Nat'l San. Foundation, School of Public Health, Ann Arbor, Mich.
- Hall, Dempsey H., Sanitarian, Creek County, 139 So. 34 West Ave., Tulsa 6, Okla.
- Mader, Dr. C. K., Food & Dairy Inspector, City Health Dept., Kitchener, Ontario, Canada
- Register, Joe Collins, Senior Bacteriologist, State Board of Health, State Hygienic Laboratory, Jackson 113, Miss.
- Rushton, Dr. F., Food Sanitarian, Ontario Department of Health, Parliament Bldgs., Toronto, Ontario, Canada
- Schlegel, John M., Milk Sanitation Consultant, Indiana State Board of Health, 521 N. DeQuincy St., Indianapolis, Ind.
- Tansey, J. A., Dairy Inspector, Health Department, City Hall, South Bend, Ind.

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- Everett, E. L., Sanitation Officer, Nansemond County, Suffolk, Va.
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- Fleischer, Max, Southern Dairies, Christiansburg, Va.
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- Fuller, M. D., State Dept. of Health, Richmond, Va.
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- Galitz, H. E., Regional Sales Supervisor, Klenzade Products, Inc., 724 Hobart Place, Beloit, Wis.
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- Jones, J. R., Southern States Co-op, Fredericksburg, Va.
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- Marthens, Bradley F., Prop. American Soap & Chemical Co., 64 Wisconsin Ave., Oshkosh, Wis.
- McLain, C. J., Farmers Creamery Co., Inc., Fredericksburg, Va.
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- Whitsitt, T. P., Manager, Mead Johnson & Co., Zeeland, Mich.
- Woltz, Charlie, Milk Sanitarian, City Health Dept., Newport News, Va.
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- Zahradka, Louis A., Gen'l Supt., Consolidated Badger Co-operative, Shawano, Wis.

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- McCarthy, Cornelius J., 1650 East Ave., Rochester 10, N. Y., to 186 Marlborough Road, Rochester 11, N. Y.
- Nielsen, Stanley R., City Hall, Clinton, Iowa, to 730 South 12th St., Clinton, Iowa
- Piper, Perry E., Cleveland, Ohio, to c/o Koester's Dairy, 1114 W. Fayette, Effingham, Ill.

(Continued on next page)

“Doctor Jones” Says—*

Thirty or forty years ago a considerable part of the doctors' practice, around this time of year, was treating people with acute “bowel trouble”. Sometimes, it was particularly sudden and violent, especially if they'd been eating meat or fish or something that wasn't too fresh, we labeled it “ptomaine poisoning”. Anyway, we always took it for granted everybody'd have a touch of it and we prepared accordingly.

Ptomaine poisoning—it wasn't long before the laboratory people were telling us that was a misnomer. A ptomaine, it seems, is a chemical substance that can result from the action of bacteria on nitrogenous matter—like meat and such stuff: a putrefactive product, the result of spoilage. Their point, I believe, was that most of the so-called ptomaines weren't poisonous. In other words, they didn't think the trouble usually came from chemical change in the food itself. But they were working on the bacteria end of it.

Then the public health people—they observed that these cases ran in bunches: maybe a hundred or so in one place, all coming down about the same

time, then another lot somewhere else. In short, they were occurring in separate outbreaks. In one place it looked like a polluted water supply; another lot—they'd had the same milk or, maybe, been to a picnic or something and eaten the same food. So the epidemiologists and the laboratory folks joined forces to find out “why?”.

The ultimate answer was: the trouble, practically always, was the bacteria themselves. In one place somebody with boils had handled milk or some other food. It hadn't been refrigerated and their staphylococci had multiplied and formed a poison. Another place the water or milk or what not had been contaminated with certain intestinal germs and the folks'd been directly infected by 'em. The bugs went to work on 'em and, a few days later, the symptoms showed up.

After the causes were known, the methods of prevention were obvious: chlorination of water supplies, refrigeration of foods, pasteurization of milk and the rest. Getting these things done—that used to occasion some “gripes” too. The best treatment for them was large doses of education. Anyway, they were less disturbing than the gastrointestinal variety.

PAUL B. BROOKS, M.D.

* *Health News*, New York State Department of Health, Albany, N. Y., August 5, 1946.

Changes in Address

(Continued from preceding page)

Ramberg (not Romberg), John W., 212 North Harriet St., Stillwater, Minn., to 210 North Greeley St., Stillwater, Minn.

West, Geo. A., 129 Elmcroft Rd., Rochester, N. Y., to Five Mile Line Road, East Rochester, N. Y.

Woodruff, A. C., 165 N. Washington Ave., Columbus, Ohio, to 2951 Mountview Road, Columbus 8, Ohio

State College of Washington

The State College of Washington will hold its Institute of Dairying for the week of March 3-8, 1947, at Pullman, Washington. For further information write to Dr. H. A. Bendixen, Acting Head, Department of Dairy Husbandry, State College of Washington, Pullman, Washington.